SCIENCE

A Textbook for Class VI

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C J Sanchorwala
Puran Chand
Ved P. Goel
Mala Chinoy
Kanhiya Lal
B K Sharma
V G Gambhir
Minaxi Shukla
Mamta Pandey
O M Shankaran

Coordinator

D Lahiry

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
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Publication Team

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Cover. Santo Datta

CONTENT EDITORS

Dr D Lahiry
Dr. Puran Chan
Dr. Ved P Go

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Foreword

THE NATIONAL POLICY ON EDUCATION 1986 emphasizes the study of science as one area of human endeavour rather than a compartmentalized sub-discipline Science continues to be an important part of the curriculum of general education and a compulsory subject for all children up to Class X

The present textbook has been written in keeping with the goals of education indicated in the Education Policy and the general objectives enunciated in the National Curriculum for Primary and Secondary Education· a Framework (1985), reflecting a national consensus. Accordingly, efforts have been made to link the content of science with some of the priority areas of national development and thrust areas The contents and activities included in the book have been organized to inculcate the knowledge, skills and attitudes on the basis of the specific objectives spelt out in the guidelines and the syllabus developed earlier Care has also been taken to make the presentation simple and flexible in order to suit the diverse needs, backgrounds and environments of the vast school systems in the country

The first draft of the textbook was developed in a workshop comprising representatives from the NCERT, New Delhi, the Vikram A. Sarabhai Community Science Centre, Ahmedabad; the Centre for Environmental Education, Ahmedabad; the CHETNA, Ahmedabad, the Kerala Shastra Sahitya Parishad, Trivandrum, the Homi Bhabha Centre of Science Education (TIFR), Bombay, and the Educational Technology Cell of the Directorate of Education, Delhi. The draft was then reviewed in a national workshop in which subject experts, teacher-educators and school teachers participated and it was modified in the light of the suggestions received It was also reviewed in another workshop in which a number of school teachers participated

Though the feedback on our earlier science book for this stage, received from teachers, pupils, parents and others interested in education, has been made use of in the development of the present version, any constructive comments and suggestions to improve the book are welcome

I acknowledge the contribution of the authors, reviewers and editors and the institutions they belong to, for making it possible to prepare the book within a short time. I am specially thankful to Dr Kartikeya Sarabhai, Director, Vikram A. Sarabhai Community Science Centre, Ahmedabad, for providing necessary facilities. Thanks are also due to Prof A. K. Jalaluddin, Joint Director, NCERT, for his keen interest and Prof B Ganguly, Head, Department of Education in Science and Mathematics, NCERT, for his active guidance in the development of the book.

P L. MALHOTRA
Director
National Council of
Educational Research and Training

Preface

THE PRESENT SCIENCE TEXTBOOK is based on the syllabus, guidelines and curriculum framework developed on the basis of the broad directives of the New Education Policy The course intends to lay down the first foundation of science as a single discipline which would not only help to understand the laws and principles governing things and occurrences in the environment but also to develop some basic competencies

The units intend to give awareness about the role of science in daily life, things and changes around the child, certain basic processes of science like measurement and separation of substances and some fundamental knowledge about the living world Some of the units deal with basic natural resources like air, water and energy as well as the balance in nature It is expected that these would help to generate a feeling of direct relevance of science to the life of the child, thus making the study of science interesting The last unit deals with the Universe. It is included to help the child go beyond this immediate environment

Efforts have been made to make the presentation of content child-centred by weaving it round the experience and environment of the child The activities which form the main plank of presentation, lay emphasis on the process of science as well as development of desirable skills and attitudes All the activities suggested can be performed with low cost and easily available materials. Moreover, these are to be selectively used, keeping in view the constraints of time, facilities and the background of pupils While some of them can be demonstrated by the teacher, even in modified form, quite a few can also be performed by pupils themselves at home

For facilitating evaluation, questions have been given at the end of each section as well as at the end of each unit A summary under the heading 'You Now Know' has been given for a quick reference by the teacher and the pupil.

AUTHORS

Participants of the National Workshop held at Delhi from 11 to 14 November 1986 to Review the Manuscript of Science Textbook for Class VI

1 Smt P D Kukde
Lecturer
State Institute of
Science Education
(SCERT), Ravinagar
Nagpur

2 Smt Renu Tuneja
TGT
Bhartiya Vidya Bhavan
Kasturba Gandhi Marg
New Delhi

3 Shri B K Sharma
Educational Technology Cell
T V Branch, Defence Colony
New Delhi

4 Shri S P Singh Tomar
TGT
Kendriya Vidyalaya No 1
Delhi Cantt.

5. Shri S.K. Kulshrestha
Lecturer in Botany
SCERT
Gurgaon

6 Shri T K Srivastava
Head, Deptt of Science and Maths
SCERT, Bihar
Patna

7 Smt Nalani Malik
TGT (Biology)
Kendriya Vidyalaya No. 3
Delhi Cantt

8 Shri C.G Gambhir
Scientific Officer
Homi Bhabha Centre for
Science Education, TIFR
Colaba, Bombay

9 Shri Kanhiyalal
PGT
Educational Technology Cell
T R Branch, Defence Colony
New Delhi

10 Dr D S Joshi
Retd Professor of Physics
and Principal of P G Science
College, 10, Dube Colony
Indore

11. Shri B R Kaushik
TGT (Science)
Kendriya Vidyalaya No 2
Kandhar Lines
Delhi Cantt

12 Shri Pritam Lal
Science Master
G S S School
Garhi Harsaru (Haryana)

13. Dr (Smt) Aruna Mohan
Reader in Zoology
Head, Zoology Deptt
Gargi College
Siri Fort Road
New Delhi

14 Shri P C Sud
Lecturer
SCERT
Solan (H P.)

15 Shri B Boraiah
Asstt Director of Textbooks
Apex Bank Building
Chamaraj Pet
Bangalore

16. Shri K V Meenakshi Sundaram
Programme Officer
SCERT
Madras

17. Km. Nitu Wadhwa
Teacher in Biology
Delhi Public School
Mathura Road
New Delhi

18. Smt J. Nagalakshmi
Lecturer (Biology)
SCERT
Hyderabad

19. Dr Mala R Chinoy
Scientist (Biology)
Vikram A Sarabhai
Community Science Centre
Navrangpura
Ahmedabad

20. Dr C J Sanchorawala
Sr Scientist
Vikram A Sarabhai
Community Science Centre
Ahmedabad

21. Shri Ajmer Singh
Lecturer (Physics)
State Institute of Science
Education, Punjab
Chandigarh

Department of Education in Science and Mathematics, NCERT, Academic Staff

1. Dr D Lahiry
2. Prof K J Khurana
3. Dr. V.N P Srivastava
4. Dr. Puran Chand
5. Dr. V P Goel
6. Shri K B. Gupta

22. Shri G P. Nema
Lecturer (Chemistry)
State Institute of Science Education
Jabalpur

23. Smt Anjali Aryan
TGT (Chemistry)
Apeejay School
Sheikh Sarai
New Delhi

24. Sushri Minaxi Shukla
Programme Officer
CHETNA
2nd Floor, Drive-in-Cinema Bldg
Thaltej Road
Ahmedabad

25. Prof D Balasubramanian
Deputy Director
Centre for Cellular and
Molecular Biology
RRL Campus
Hyderabad

Participants of Review Workshop held from 10 to 14 February 1987

1. Smt Prabha Mathur
TGT (Science)
Kendriya Vidyalaya
Sector II, R K Puram
New Delhi

2. Smt. R Agnihotri
Kendriya Vidyalaya
Sector IV, R K Puram
New Delhi

3. Smt Mary Ooomenen
Kendriya Vidyalaya
INA
New Delhi

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Science in Everyday Life

HAVE YOU EVER TALKED to your grandparents about the type of houses and the mode of travel and communications prevailing in their childhood? They will tell you that since then things have changed a lot. Stainless steel, nylon, plastic, television and jet aeroplanes were unknown to them Everything has considerably improved, such as the quality of clothes, medicines and entertainment. Do you know how this improvement has come about? It is through science and its application that this fast development and improvement have come about Science helps us in acquiring new knowledge about things and happenings around us It has improved our existing knowledge and devices Through hard work and systematic approach we solve many problems Scientific thinking helps us invent new devices In this unit, you will learn how science and its methods help us

1.1 *Science Helps*

It happened in Greece long, long ago The army of a king attacked a neighbouring kingdom The capital was far away and the other king did not know about this attack People wanted to inform their king immediately One person was asked to do this job. He started running towards the capital He ran nearly 40 km, reached the capital, gave the message to the king, fell down and died Do you now need to run like this to send messages? Do you know some other modes of sending messages which were commonly used in earlier times? Can you name some other means of communication which we use these days?

Fig 1.1


OIL
125

The newspapers and the radio give us information of events occurring even in far-away countries Events like cricket matches, celebrations in countries overseas also can be seen on television (TV) while they are happening Using the telephone you can talk to a person at a far-away place

Till recently, lakhs of people in the world died of diseases like smallpox, malaria and plague every year During these epidemics, they had to run away from their villages or cities to other places Nowadays, we do not even hear about plague or smallpox. Medicines and vaccines protect us from many diseases.

Look at Fig 1 2 This shows how things have developed.

All these developments have come through science. It is necessary to keep in touch with these developments People always try to get more knowledge and use it suitably You, too, must be curious about many things. You also need to know more about things and happenings for better living You can learn through books, magazines, radio and television and from elders You get knowledge by observing things and events very keenly and asking the elders questions.

ANSWER THESE

1 Name three different modes of transport that help you travel fast Which is the fastest among them?

2 How has science proved advantageous with regard to the following.

Cycle	Car
Hand-stitching	Sewing-machine
Pigeon carrying message	Telephone
Drawing water from a well	Pump
Writing	Typing
Hand Fan	Ceiling Fan

←Fig 1 2

1.2 *How Does a Scientist Work?*

Scientific methods are used by us in cooking and other household activities A farmer working in the field and a potter making earthen pots also use scientific methods. Even when you notice some harsh sound made by your bicycle, you use a scientific method to detect the cause and repair the fault First you try to find out which part, like the chain, paddle or wheels, is producing that sound Then you check carefully and try to find the exact part that makes the sound. You observe the part keenly and decide why it is making that sound You then decide what needs to be done. Accordingly, you readjust the part, oil it or decide to replace it.

(Fig 1.3)

A scientist works in the same way.

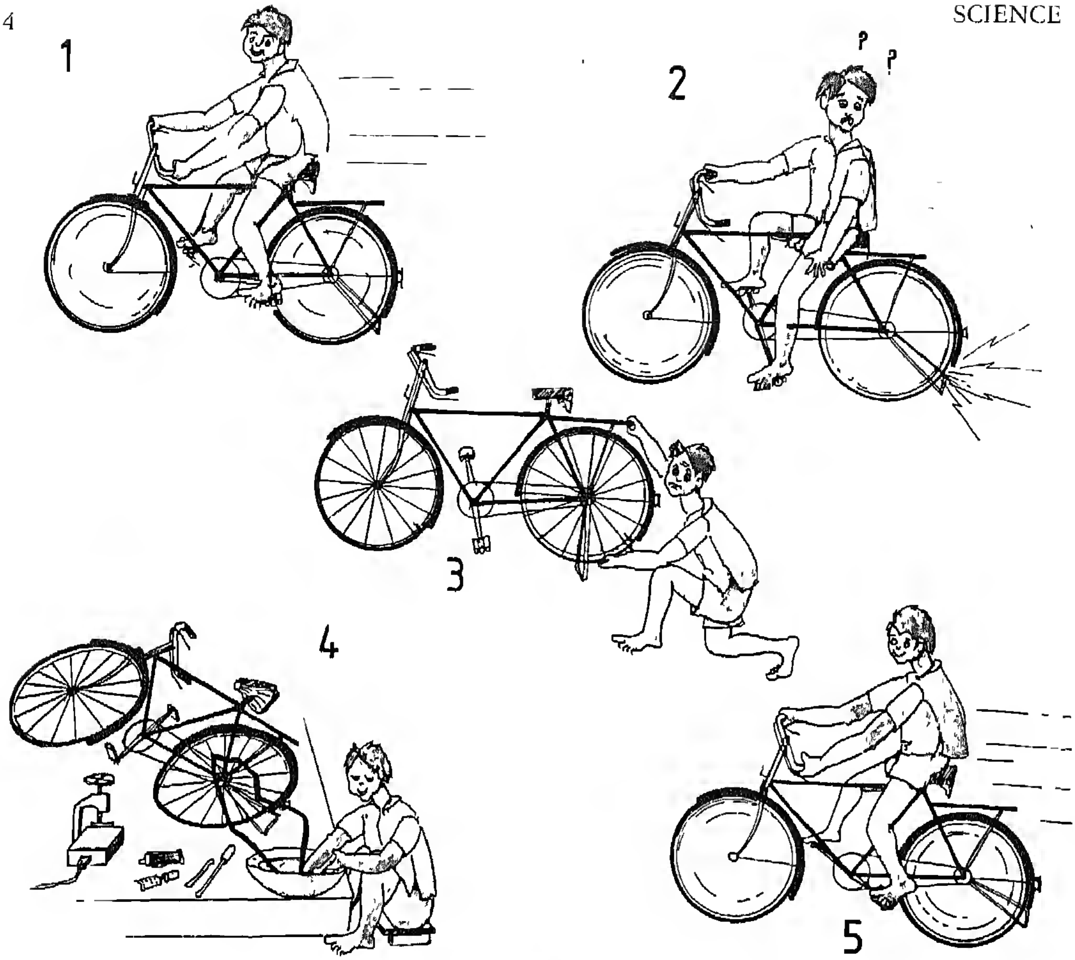


Fig 1.3

He first gathers information to identify the problem He then collects more information through keen observation, measurements, etc. He thinks over the observations and possibilities. He tests each possibility by experiments or repeated observations to collect data He then calculates, compares and draws conclusions If he finds his thinking incorrect, he tries to find out the mistakes and readily corrects himself. This is the scientific approach

Remember that a scientist never concludes without having enough evidence A doctor is a scientist and he is familiar to us Observe how he works

(Fig. 1 4)

(i) He gathers information by asking you questions (How long have you been suffering? Where do you feel the pain?)

(ii) He examines the different parts of your body

(iii) He measures temperature, pulse rate, blood pressure, etc

(iv) He records these observations and keeps them in mind

(v) He analyses the possible reasons of the sickness and makes certain assumptions

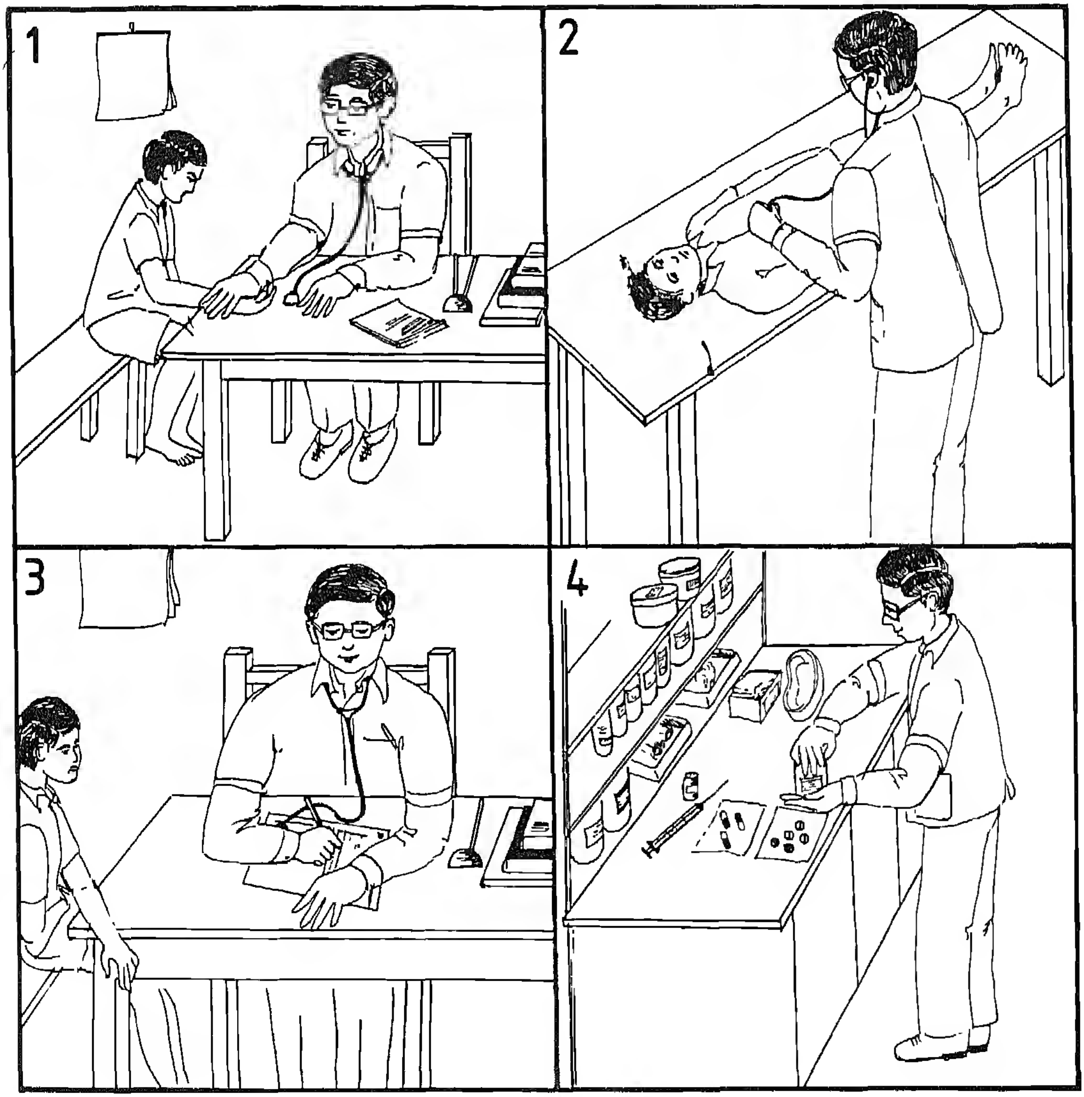


Fig. 1.4

(vi) He gives appropriate medicines on the basis of his assumption

(vii) He then confirms his assumptions by conducting tests of blood, stool, urine and through X-rays

(viii) He finally decides the course of treatment according to the results

ANSWER THESE

1. Take four different types of seeds such as peanut, gram, bean and moong Find out the proper conditions for seed germination Set up an experiment Observe the seeds everyday Note down your observation
   — Do all seeds germinate at the same time?
   — Is the growth rate the same in all seeds? Explain your findings
2. Ask a gardener or a farmer about how he selects the seeds Note the information in your notebook.
3. You are given sand and soil, separately You are also given some gram seeds. You have to find out whether sand or soil is more suitable for seed growth. What method would you follow to find it out?

1.3 *Is Science Good or Bad?*

The scientists try to apply their knowledge in a useful way Scientists of different countries have contributed to the progress of science. The people of the Asian countries had taken a lead in scientific discoveries in earlier times Aryabhata was a well-known Indian mathematician Nagarjuna, an ancient Indian scientist, discovered many methods of curing diseases using plants as medicines This method of treatment is called Ayurveda It is practised in many places in our country, China and several other regions of the world In recent times, Jagadis Chandra Bose studied the sensitivity of plants in detail The hard work of scientists such as Sir C V. Raman, S Ramanujan, S N Bose, M.N Saha, D N Wadia, B Sahani, P. Maheswari, G N Ramachandran, T R. Sheshadri, Homi Bhabha and Vikram Sarabhai has helped our country to progress in many fields At present there are a large number of scientists in India helping significantly in the growth of science and the development of the country

A scientist named Edward Jenner worked very hard and found out a vaccine to protect people from getting some diseases This vaccine protected many people against diseases all over the world. Similarly, Alexander Fleming discovered a very effective medicine called penicillin Penicillin has cured many people from various infectious diseases You must have heard of Madame Marie Curie, a Polish scientist She worked very hard and invented radium and polonium One scientist, Leeuwenhoek, prepared a microscope and

observed many tiny things. Microscopes proved useful in studying different types of germs, examining the blood, and so on Methods to preserve milk, jam, etc, were found out by Louis Pasteur These methods are being used by food industries

Science has helped to solve many of our problems like food, health and transport Pumps and canals provide us more water for irrigation Better seeds, fertilizers and insecticides are available now You can save crops from many diseases In spite of that many people do not get enough and proper food Medicines for certain diseases such as cancer are yet to be discovered Industries help us produce more commodities At the same time, however, some waste materials like smoke and some chemicals are produced Some of these make air and water impure They harm plants, people and animals How to minimize these effects? Answers to such questions need to be found out through scientific investigations and applications.

An old person can use a stick for support A stick helps a blind man to move on a right path. Somebody can use a stick to damage glassware, toys or flower pots. Sometimes science, too, is used in harmful ways Once people learnt that certain substances explode easily, they made bullets, bombs and crackers. These were devised for our safety and security. Some people misused bullets to kill animals in the forests and to commit dacoities. The existence of some beautiful animals and birds is in danger A powerful bomb used in a war can kill many innocent people It can destroy buildings and factories Some people try to use poisonous gases in war These gases kill animals, plants, innocent people. The crops are destroyed and farms become infertile All such destructive uses of science must be avoided

Answer These

1 Name three scientists and mention their contributions to science
2 Mention two advantages and two disadvantages of factories

YOU NOW KNOW

1 Science helps in development and inventions and in improving our ways of doing and thinking
2 Reading, listening to elders, observing keenly and clearing your doubts by consulting experts are the ways of acquiring knowledge
3 The scientific method consists of the following steps·

(i) Observation
(ii) Gathering basic information
(iii) Identifying the problem
(iv) Thinking about the probable causes

(v) Testing each of the probable causes through keen observation and experimentation

(vi) Finding out the result and drawing conclusions

(vii) Correcting ideas, whenever necessary

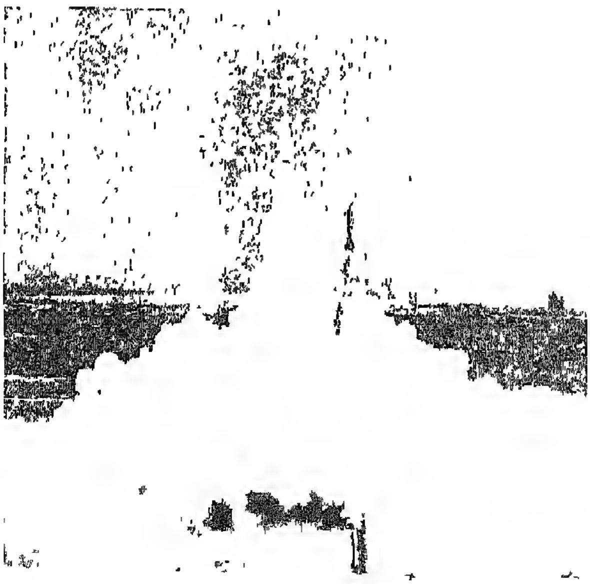
4. Science should be used for the welfare of the people and not for harming them

NOW ANSWER THESE

1 Name a device by which you can see things which are
   (i) very tiny
   (ii) far away

2 How can you make yourself audible in a large gathering?

3. How will you find out whether the water available in your locality is fit for drinking or not?



Things Around Us

THERE IS A VARIETY of things around you Some of these objects are natural Some are man-made We use many of these objects in our day-to-day life in different ways All these things are of different shapes, sizes and colours They have different properties In order to understand the things around you, it is useful to group them. In this unit you will learn the basis of grouping

What are these objects made of? Are all objects made of the same kind of material? What are materials? How are materials different? Are the materials made of fine particles? In what ways are these particles arranged in solids, liquids and gases? You will find answers to these questions in this unit.

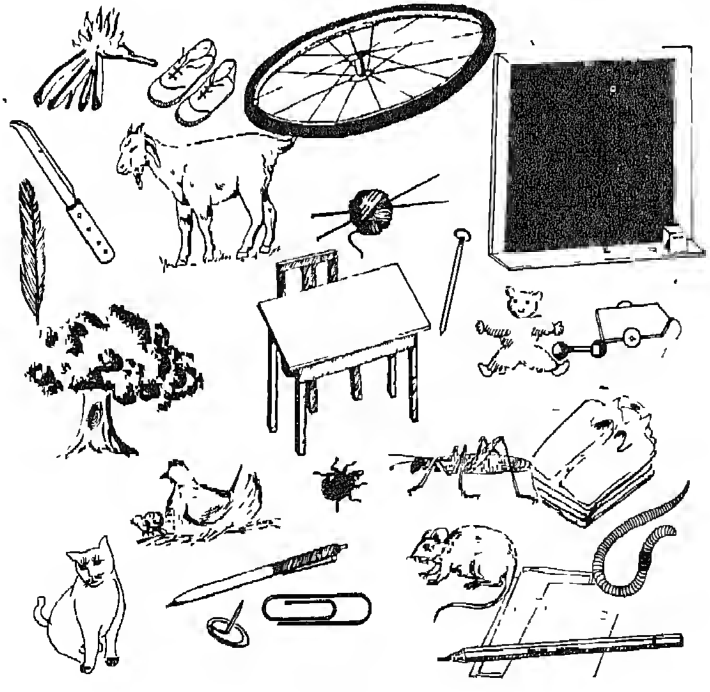


Fig. 2.1

2.1 *Classifying Things*

You see a variety of things around you such as animals, black-board, birds, chalk, chairs, clothes, fire-wood, insects, knife, paper, plants, sand, shoes, tables, tyre, toys, trees, utensils, and so many other things (Fig.2 1). All the objects may not be alike How are they different? They may also be alike in some ways Do you know how they are alike?

Activity 1

Collect and list out at least twenty objects that you see in your surroundings Write at least one use of each of them Are they all of same size, shape and colour? Thus, you see a variety of objects around you. These are a few examples of the variety of objects on the earth There is also a variety in the objects in the sky such as the moon, the sun and stars.

Activity 2

Visit a grocer's shop in your locality Observe how the objects are arranged.

In the shop the objects being sold are usually placed in groups For example, all kinds of soaps are placed together. All pulses are kept at one place and spices of all kinds are kept at another place, and so on

When you want to purchase something, you or the shopkeeper can locate it easily. Suppose these things in the shop are all mixed up on the shelves. Will it be easy for you or the shopkeeper to locate a particular thing?

Thus, grouping the objects in a proper way makes it easier to work with them

How are the objects grouped in the kitchen? How does it help? In your daily life also you group various kinds of objects for your convenience, for example, books, writing materials and clothes In what other places do you see the objects arranged in groups Give four examples

The process of grouping and sorting objects is called *classification.* Classification of various objects can be done on the basis of their similarities and dissimilarities This may be based on their use, colour, size, shape, hardness, texture, etc They can also be classified as living or non-living In what other ways can you group objects?

In a particular group of objects, if you know the properties of one member, it may help you to know about the others

Activity 3

Classify the buttons shown in Fig. 2.2(a) any way you like Can you classify them? If not, why?

See Fig 2 2(b) and classify the buttons any way you like For example, the number of holes may be one of the many ways of classification Are you able

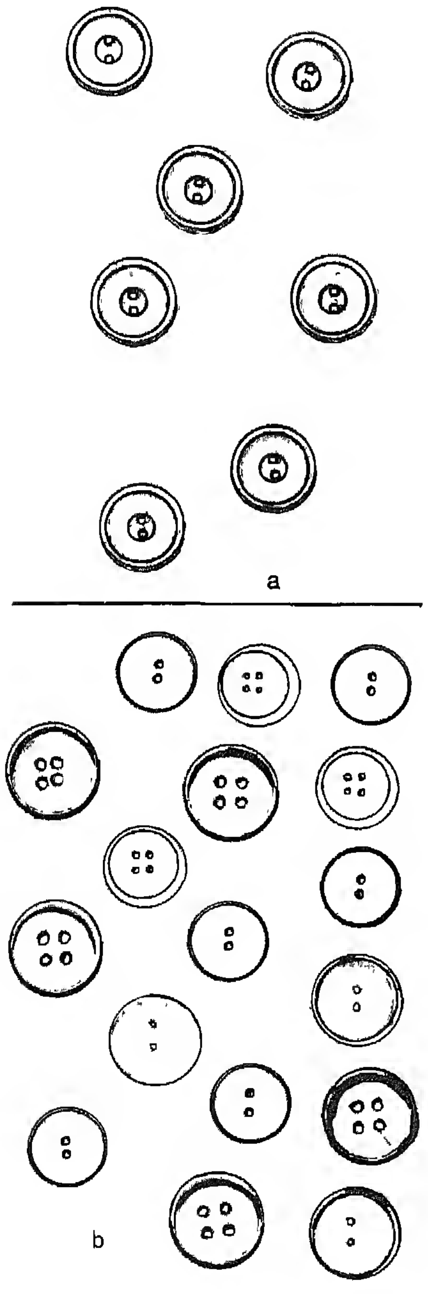


Fig. 2.2 *(a) Similar buttons*
(b) Different buttons

to classify them in different groups? If yes, how?

Thus, you can conclude that the objects cannot be classified when they are all alike or all different Classification can be done only when objects have some similarities and some dissimilarities.

All objects may be grouped as living or non-living Unlike non-living objects, living objects need water, air, and nutrients for their survival.

Activity 4

(i) Some objects are shown in Fig.2.1 Classify them as living and non-living objects Group them in tabular form

(ii) Can you classify the living objects further in two groups, that is, plants and animals Now try to classify all the living objects listed by you in these two groups. Compare your groups with those of your classmates Are they the same or different?

Classify the animals around you in different groups and compare your findings with those of your classmates

Activity 5

Classify the non-living objects listed in Activity 4 in two or more groups any way you like. Compare your groupings with those of your classmates Are the groupings the same?

All the objects are made up of one or more materials Materials may be man-made or occurring naturally Some examples of naturally occurring materials are coal, wood, rocks, minerals, water, gold and petroleum [Fig 2.3 (a)]

Many materials are man-made such as glass plastic, fertilizer, paper and stainless steel [Fig. 2 3 (b)]

Activity 6

List at least five other materials which occur in nature Mention five more man-made materials.

(i) List in Table 2.1 five objects each of which is made of different kinds of materials. One example is given in the table

TABLE 2 1

S.No	*Objects*	*Materials*
1.	Tumbler	Glass, plastic, wood, silver, brass, stainless steel
2		
3		
4		
5		
6		

(ii) List in Table 2.2 five materials each of which can be used to make different kinds of objects. One example is given in the table.

TABLE 2.2

S No	*Materials*	*Objects*
1.	Plastic	Tumbler, mug, bucket, tooth-brush
2		
3		
4		
5		
6		

(iii) List in Table 2 3 five objects each of which is made by assembling different kinds of materials One example is given in the table

TABLE 2.3

S No	*Objects*	*Constituting Materials*
1	Vegetable curry	Vegetables, salt, ghee, spices, water
2		
3		
4		
5		
6.		
7		

Thus, you find that the same object may be made of different materials. Similarly, many kinds of objects can be made of the same material. Many objects are made up of a combination of materials.

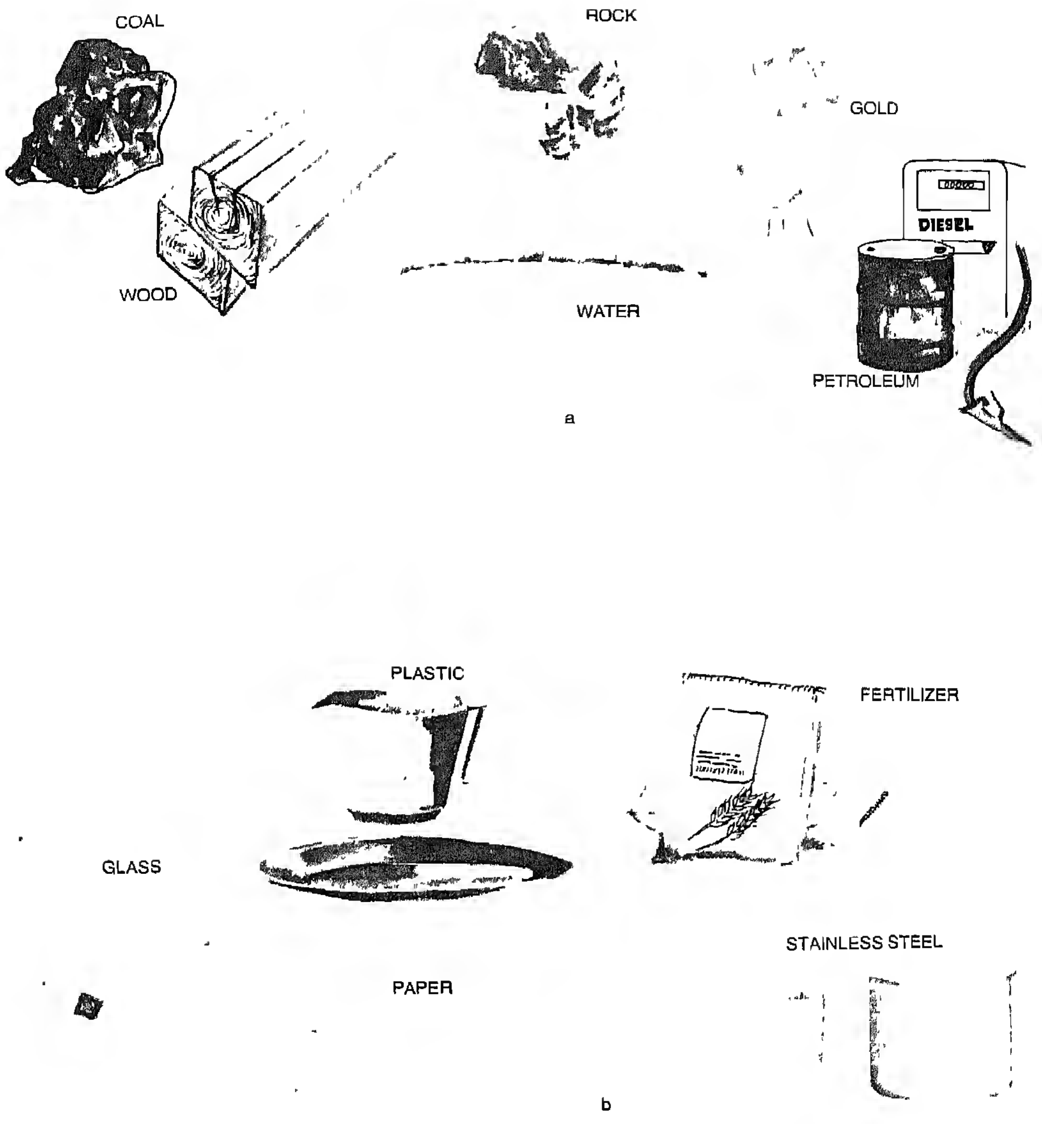


Fig. 2.3 *(a) Naturally occurring materials*
(b) Man-made materials

ANSWER THESE

1. Why do we need to classify objects?
2. If you have objects similar in all respets, can you classify them in different groups?
3. On what basis are the various objects grouped?

2.2 *What is Matter?*

You know that objects are made up of materials. Now you will learn something more about materials. All materials and substances are made up of matter. Anything which you can see, touch, smell or taste is *matter*.

Activity 7

Take a piece of stone in your hand. Do you feel its heaviness? Take two empty glass tumblers. Fill one of them with water. Lift both the tumblers. Which one is heavier? The heaviness is due to the amount or mass of the water in the tumbler.

Activity 8

Take a football with bladder. Pump air into the bladder as much as you can. Close the opening. Take a sensitive balance. You can improvise one with a metre scale as shown in Fig. 2.4. Suspend the inflated football from one end of the balance. From the other end suspend a plastic bag. Put some sand into the bag to make the beam horizontal. Now release the air from the football. Is the beam still horizontal? You will find that the beam tilts down towards the plastic bag. This shows that *air has mass.*

Fig. 2.4 *Air has mass*

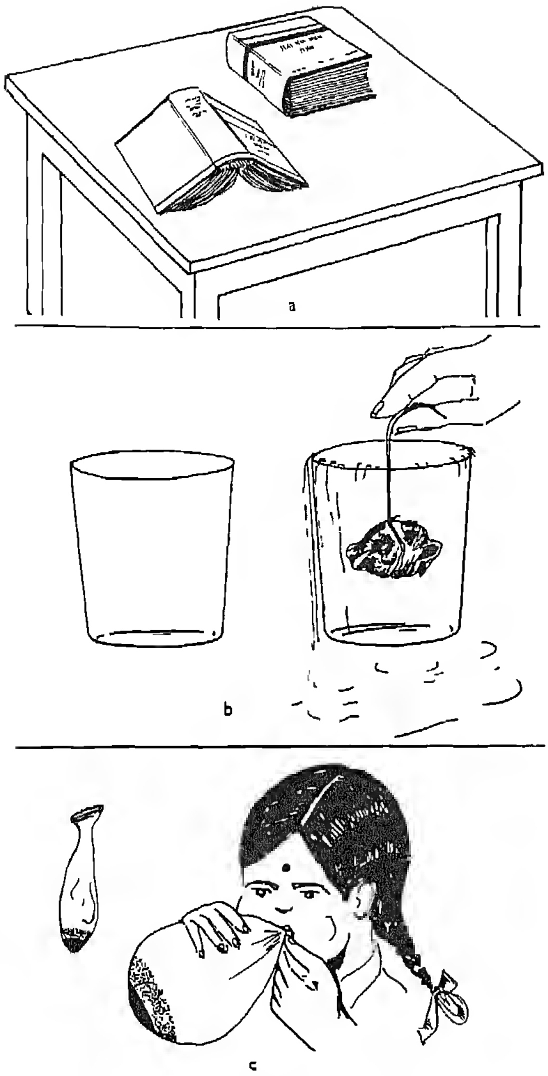


Fig 2.5

Thus you find that a piece of stone, water and air have mass. All matter has mass.

(i) Put a book on a table [Fig. 2 5 (a)] Does it occupy space?

(ii) Fill a glass tumbler completely with water. Water occupies space in the tumbler Put a small piece of stone in the tumbler [Fig. 2 5(b)] What do you observe?

You see that the piece of stone pushes some water out of the tumbler. It means that the stone has occupied some space in the tumbler The amount of space the stone takes up is called its *volume.*

(iii) Take a balloon and blow air into it [Fig 2.5(c)] What do you observe? You see that the air makes the balloon take up more space That is, the balloon becomes bigger in size

Thus, you find that a book, water, a piece of stone and air occupy space. That is, matter occupies space.

Anything that has mass and occupies space is called matter.

DIFFERENT STATES OF MATTER

Matter can exist in three different states—solid, liquid and gaseous At room temperature, wax is solid, water liquid and carbon dioxide is gaseous. changing the temperature, the state matter can be changed. Some forms of matter can be changed from one state to another and then brought back again to the original state. The three different states of water are shown in Fig. 2 6

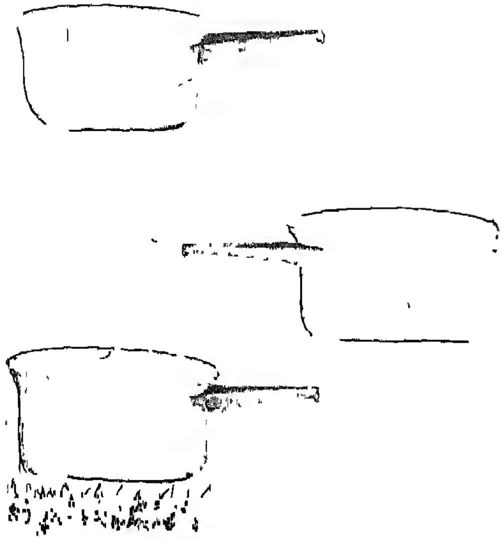


Fig. 2.6 *Different states of water*

The process of changing a solid into a liquid by heating is called *melting*. The melting of a substance takes place at a fixed temperature. This temperature is called the *melting-point* of that substance Ice melts at 0°C Ice on melting forms water

On boiling water forms steam Steam is in gaseous state Most of the liquids keep on changing slowly into vapours at all temperatures. This process is called *evaporation*

The process of changing a liquid into a gas becomes faster on heating On continued heating the temperature of the liquid rises and it starts boiling at a fixed temperature. This temperature is called the *boiling-point* of the liquid Water boils at 100°C.

You must have observed in the kitchen that when water boils in a vessel, water droplets are formed on the lid. Where do these water droplets come from? These water droplets are formed when steam cools on the lid and gets converted into water The process of changing vapours of a gas into a liquid by cooling is called *condensation*.

Have you ever thought how ice is formed from water?

Water on cooling turns into ice This is called *freezing*. Freezing is a process of changing a liquid into a soild on cooling

$$\underset{\text{(gas)}}{\text{Water vapours}} \xrightarrow[\text{condensation}]{\text{cooling}} \underset{\text{(liquid)}}{\text{water}} \xrightarrow[\text{freezing}]{\text{cooling}} \underset{\text{(solid)}}{\text{Ice}}$$

Conversion of water from one form to another may be written as

$$\underset{\text{(solid)}}{\text{Ice}} \underset{\text{freezing}}{\overset{\text{melting}}{\rightleftharpoons}} \underset{\text{(liquid)}}{\text{water}} \underset{\text{condensation}}{\overset{\text{boiling}}{\rightleftharpoons}} \underset{\text{(gas)}}{\text{steam}}$$

Activity 9

Take a candle Light it with a match stick You can see the liquid wax just below the flame Blow off the candle. Observe the white fumes of the wax coming out of the wick (Fig 2.7). This is the gaseous form

Fig. 2.7 *Different states of wax*

of wax. Bring a burning match stick quickly near the fumes. The fumes will burn and light the candle again. This shows that wax can exist as a solid, a liquid and a gas.

Can you give some more examples of substances which change from one state to another?

Gold, copper, iron and silver change to liquid and gaseous states at high temperature.

ANSWER THESE

1 Matter has ________ and occupies ________________

2 How will you show that air is matter?

3. "You are matter." Is it a correct statement?

4. The amount of space matter takes up is called
   (i) mass
   (ii) volume
   (iii) area

5 Name three different states of matter.

6 The process by which steam changes into water is called ________ .

7. Freezing is a process of changing ________ into ________ .

2.3 *Classification of Materials*

Materials are classified on the basis of certain characteristics such as their state, their solubility in water, their behaviour towards magnet, their heaviness or lightness with respect to water, their transparency or opaqueness, etc

Activity 10

List twenty materials which you use in your daily life Classify them on the basis of their state as solids, liquids or gases in tabular form.

Activity 11

Take five test-tubes. (If test-tubes are not available, take glass tumblers.) Fill each of them about half with water. Keep them in a test-tube stand.

Add a pinch of sugar, chalk powder, washing soda and sand each in four test-tubes Add a few drops of kerosene in the fifth test-tube Shake them well. Keep them again in the test-tube stand (Fig. 2.8) Observe the test-tubes after a few

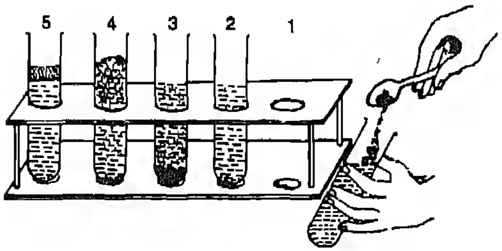


Fig. 2 8 *Materials—soluble and insoluble in water.*

minutes You will observe that in some of the test-tubes the added material has disappeared These materials are *soluble* in water. Other materials which are left as such in the test-tubes are *insoluble* in water. Identify the soluble and the insoluble materials

List some more materials which are soluble and insoluble in water.

Activity 12

Place pins, clips, nails, wood shavings, plastic buttons, chalk-powder, a piece of copper, an aluminium spoon separately on a piece of paper Bring a magnet near each of these objects. List the objects that are attracted by the magnet. You will find that the objects made of iron are attracted by the magnet

Activity 13

Take some objects made of different materials, such as a nail of iron, a piece of copper, an aluminium spoon, a small plastic toy, a small piece of wood, a small piece of stone, a piece of chalk, small amounts of kerosene and cooking-oil

Fill a glass tumbler to about two-thirds with water Drop one object from the above list at a time in the tumbler. Observe whether the object floats or sinks List the objects which float in water.

Objects that float are *lighter* than water Those that sink are *heavier* than water.

There are some objects through which you can see, for example, glass and water. They are called *transparent*. There are some objects through which you cannot see. They are called *opaque*, for example, a piece of card-board, a sheet of your notebook and a sheet of glazed paper

Can you give some more examples of transparent and opaque objects? Thus, these properties form the basis of classifying things There are many other properties which can be used for classification.

ANSWER THESE

1. Mention three materials which are soluble and three which are insoluble in water.

2. Classify the following materials on the basis of their state
   water, carbon dioxide, common salt, coconut oil, milk, sugar, spirit, petrol, oxygen, candle wax
3. A magnet attracts objects made of ______________

2.4 *Elements and Compounds*

Things around you seem to be of endless variety How is this variety obtained? What are all the objects and materials made of?

To answer these questions, let us consider the following·

(i) There are only 26 letters in the English alphabet. Different combinations of these letters make a large number of words

(ii) Only ten digits from 0 to 9 make innumerable numbers

(iii) A variety in music is obtained by using different combinations of only a few basic musical notes.

Similarly, a large number of objects and materials are made up of only a few basic units (building blocks) There are ninety-two naturally occurring basic units on the earth These basic units are called *elements*. A few more elements have also been prepared by scientists Now there are more than 100 known elements The elements are said to be the building blocks of materials in the same way as bricks are the building blocks of a building.

Some of the common elements are hydrogen, helium, carbon, nitrogen, oxygen, sodium, magnesium, aluminium, silicon, phosphorus, sulphur, zinc, bromine, silver, tin, iodine, gold and mercury. Most of the common materials are made up of one, or more than one of these elements

Only a few elements occur free in nature, for example, oxygen, nitrogen and gold. Most of the materials around us are combinations of two or more elements. Water, a common substance, is made up of two elements—hydrogen and oxygen (Fig. 2 9)

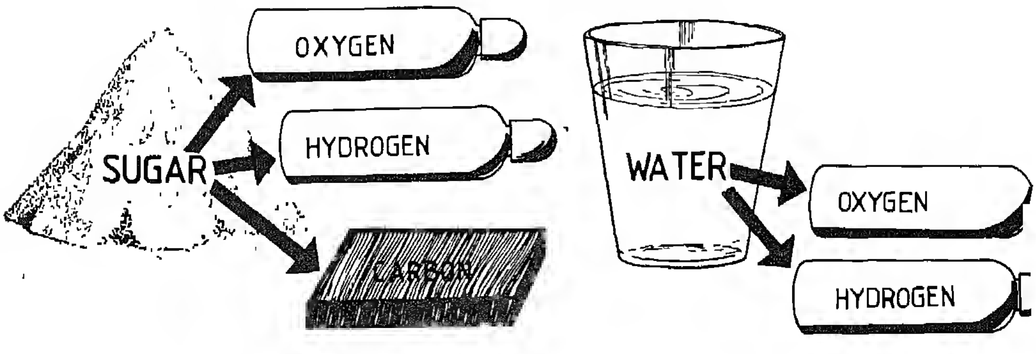


Fig. 2.9

Sugar is a combination of carbon, hydrogen and oxygen Common salt is made of sodium and chlorine.

Substances that consist of two or more elements combined together are called *compounds*.

Substances as different as skin, hair, leather, wool, wood and muscle mainly contain several compounds of elements of carbon, hydrogen, oxygen and nitrogen Petrol, kerosene and candle wax are made up of compounds of carbon and hydrogen. The elements found in largest quantity on our earth are silicon and oxygen. Many man-made and natural materials contain compounds of these two elements. Some examples are sand, bricks, glass, concrete, clay and granite

Each element has its own special properties. They help you in identifying the elements Some elements are solids, some are liquids and others are gases at room temperature (25°C)

Elements are classified mainly as metals and non-metals. For example, iron, copper and gold are metals, whereas carbon, sulphur, hydrogen and oxygen are non-metals (Fig 2 10).

Metals are good conductors of heat and electricity That is, they allow heat and electricity to pass through them Metals have lustre They are generally solid. Mercury is the only metal which is liquid Non-metals can be solids, liquids or gases

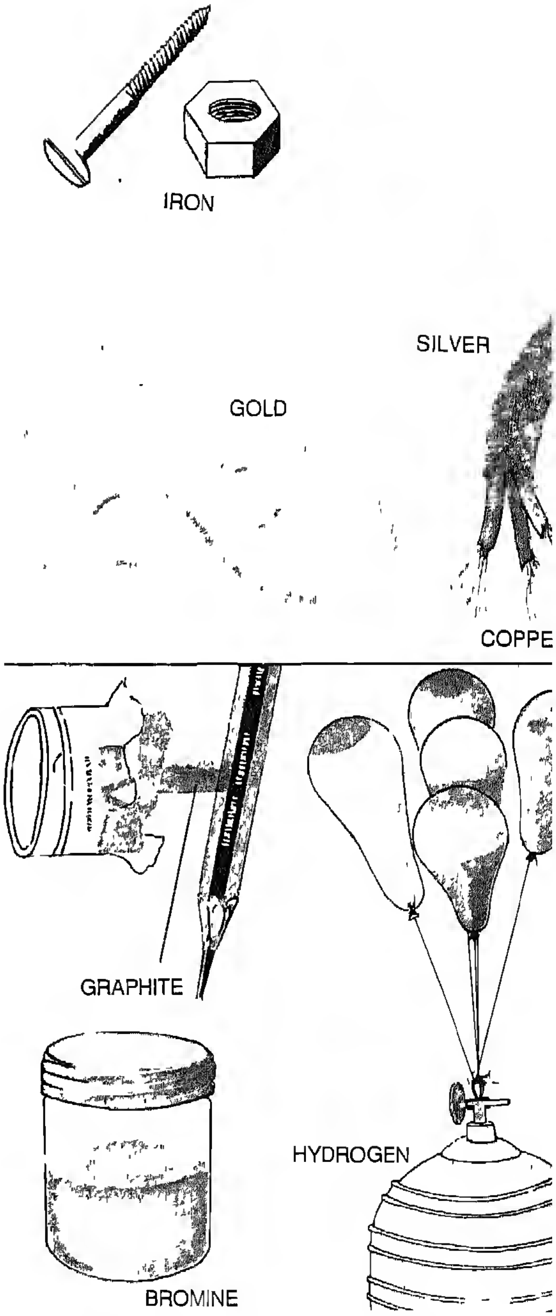


Fig. 2.10 *Some metals and non- metals*

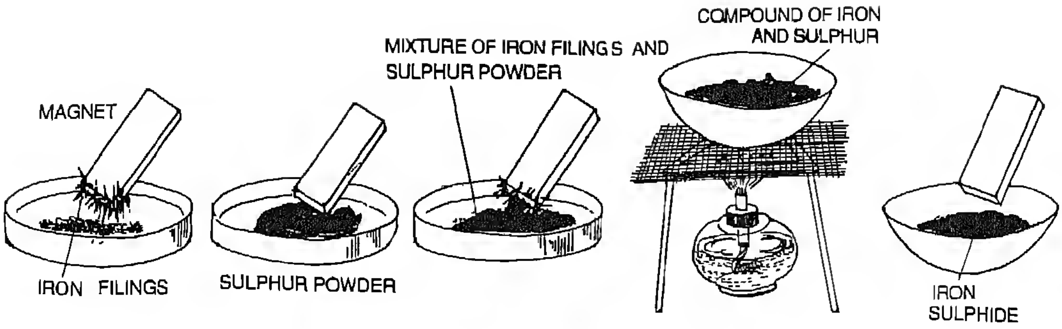


Fig 2.11 *Difference between a compound and a mixture*

Activity 14

Some commonly used metals are given in Table 2 4 Write at least two uses of each against them (You may consult your parent/teacher/friend)

TABLE 2 4

S. No	*Metals*	*Uses*
1	Iron	
2	Copper	
3	Silver	
4.	Gold	
5	Mercury	
6	Aluminium	

Activity 15

Take about a teaspoonful of sulphur powder in a dish. What does the sulphur look like? It is yellow

Take about a half teaspoonful of iron powder in another dish. It is grey in colour Bring a small bar magnet near the iron powder (Fig. 2.11) What do you observe? The iron powder is attracted to the magnet and sticks to it

Mix both the iron powder and the sulphur powder in a separate dish Look carefully. Do you still see the iron powder and the sulphur? Bring the bar magnet near it. What do you observe?

The properties of iron powder and sulphur did not change when you mixed them. This is a mixture of iron and sulphur

Now take this mixture of iron powder and sulphur in a porcelain dish (If porcelain dish is not available, use small iron plate.) Heat the dish on a spirit lamp for some time till it starts glowing Remove the dish from the flame and allow it to cool Remove the cool material from the dish on a piece of paper

Do you now see the grey iron powder and the yellow sulphur powder? Can you separate the iron with a magnet? Write your observations in Table 2 5

TABLE 2.5

Substance	*Appearance*	*Behaviour towards a Magnet*
Iron Powder		
Sulphur		
Mixture of Iron and Sulphur		
Compound formed from Iron and Sulphur		

You will see that the new material which is formed, does not have the properties of either sulphur or iron. It is grey in colour You cannot separate iron from it with a magnet. Here, iron and sulphur have combined to form a new material, iron sulphide, which is a *compound* You can write this combination as

Iron + Sulphur $\rightarrow$ Iron sulphide
(Element) (Element) (Compound)

Thus, you can say that the properties of compounds are altogether different from those of the elements they are made of.

When two or more substances (elements or/and compounds) are mixed together in such a way that they do not lose their own properties, they form a *mixture.*

Activity 16

Some commonly used compounds are given in Table 2.6. The elements which constitute them are also written against them. List at least one use of each of them

TABLE 2.6

Compounds	*Elements*	*Uses*
Urea	Nitrogen, Carbon, Hydrogen, Oxygen	
Washing-soda	Sodium, Carbon, Oxygen	
Kerosene	Carbon, Hydrogen	
Quinine	Carbon, Oxygen, Nitrogen, Hydrogen	
Sugar	Carbon, Hydrogen, Oxygen	

ANSWER THESE

1. Name three elements found in free state in nature
2. Mention two different characteristics of a metal and a non-metal
3. Name two elements which occur in gaseous form.
4. Common salt is formed by combining the elements ______and______
5 Classify the following as elements or compounds
   iron, iron sulphide, sulphur, chalk, washing-soda, sodium, carbon, urea.

2.5 *Atoms and Molecules*

You have learnt about elements and compounds. All elements and compounds are made up of fine particles. Let us try to have an idea about these particles.

Activity 17

Take a sprayer. Spray kerosene with it against light. You will see a mist is formed owing to very fine drops of kerosene (Fig. 2 12)

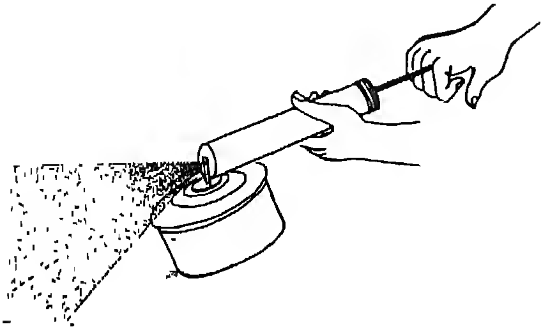


Fig. 2.12 *Spray*

Take a piece of chalk and grind it to a very fine powder Do you see fine particles?

The fine particles of kerosene and chalk still have the properties of their compound (kerosene and chalk). It means that kerosene is made up of fine particles of kerosene. Chalk is made up of fine particles of chalk Thus, a compound is made up of fine particles of the same kind These are the smallest particles you can see If by some means you could break these particles further into smaller and smaller particles, then you would finally get the smallest possible particle of the compound. This smallest particle cannot be seen It still has the properties of the compound This is called a *molecule* of the compound.

Water is a commonly used compound. It is possible to break the molecules of water. This can be done by passing electric current through water. Water breaks into hydrogen and oxygen (Fig 2.13) Both have different properties They are unlike the original substance, water

Hydrogen gas is made up of the molecules of hydrogen Oxygen gas is made up of the molecules of oxygen.

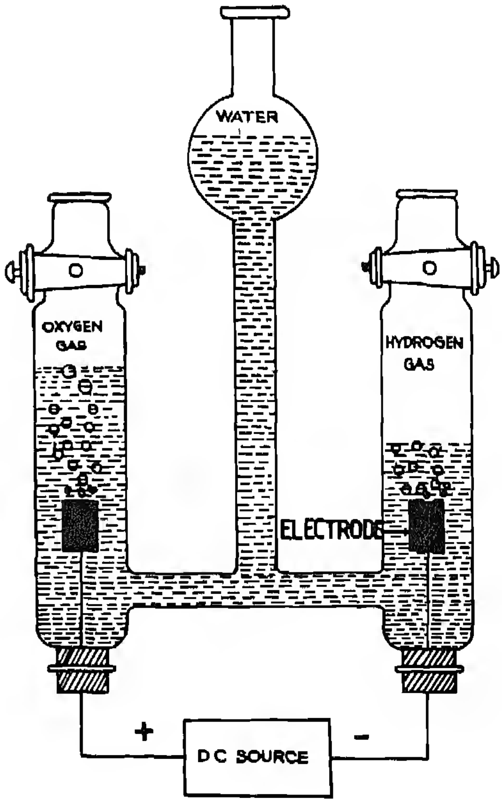


Fig. 2.13 *Electrolysis of water*

A molecule of hydrogen can be split further into two particles. The smallest possible particle of hydrogen is called an *atom.* An atom does not exist alone Similarly, a molecule of oxygen consists of two atoms of oxygen

A molecule formed from the same kind of atoms is called the *molecule of an element.* For example, two atoms of hydrogen combine to form a molecule of the element hydrogen. A molecule which consists of atoms of two or more different elements is called the *molecule of a compound.* An atom of chlorine combines with an atom of hydrogen to form a molecule of the compound, hydrogen chloride

All elements are made up of only one kind of atoms

All atoms of an element are identical and alike. For example, all atoms of copper are identical and alike. All atoms of aluminium are identical and alike. But the atoms of copper are different from those of aluminium Similarly, *all molecules of a compound or an element are identical and alike.* For example, all molecules of sugar are identical and alike All molecules of water are identical and alike But the molecules of sugar are different from those of water.

Now can you imagine how small atoms and molecules are? They are so small that they cannot be seen even by the most powerful microscope. But a collection of a very large number of atoms or molecules can be seen

> You will wonder that a thin gold or silver ring contains about 1000000000000000000000 atoms.
>
> One teaspoonful of water contains as many molecules as the Indian Ocean contains teaspoonfuls of water.

ANSWER THESE

1. How many atoms are present in a molecule of oxygen?
2. Fill up the blanks·
   - (i) The smallest particle of matter which can exist by itself is called ______ .
   - (ii) All elements are made up of ______ kind of atoms.
   - (iii) A molecule of a compound consists of the ______ of two or more ______ .
   - (iv) A molecule of an element consists of atoms of ______ element

2.6 *Solid, Liquid and Gas*

You have seen that matter exists in three states—solid, liquid and gaseous For example, water exists as ice (solid), water (liquid) and water vapour (gas) The molecules in all the three states are the same. Why does this difference in the states occur? This is due to the difference in the arrangement of molecules in solids, liquids and gases.

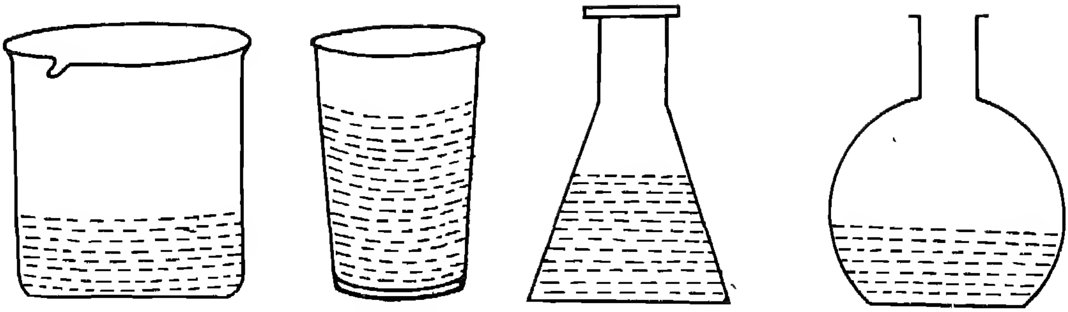


Fig 2.14 *Liquid takes the shape of the vessel in which it is poured*

In solids, the molecules are closely packed Their positions are almost fixed That is why solids retain their shape Their volume does not change For example, a brick or a piece of chalk or a utensil does not change its shape on its own

In liquids, the molecules are not packed as closely as in solids Liquids, therefore, change their shape easily

Activity 18

Take a glass tumbler and fill it with water Mark the level of the water in it Pour the water by turn into vessels of different shapes (Fig 2 14) Observe the shape of the water in each vessel You will see that the water takes the shape of the vessel into which it is poured Now pour the water again into the tumbler. Is there any change in the volume of water?

Thus, you will find that liquids change their shape, but their volume does not change.

In gases, the molecules are at a greater distance from one another as compared to solids and liquids (Fig

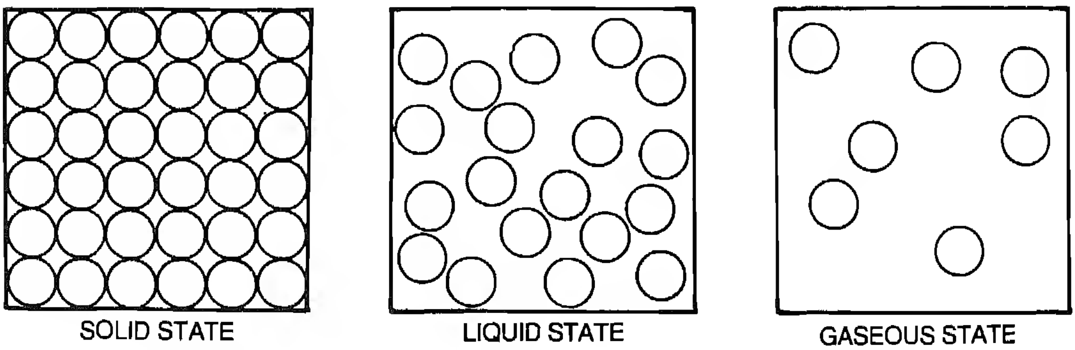


Fig. 2.15 *Arrangement of molecules in the three states of matter*

2 15) They are free to move The gases, therefore, neither have a fixed shape nor a fixed volume They take the shape and the volume of the container they are kept in

Activity 19

Take two balloons of different shapes and sizes Tie a small piece of glass tube to one of the balloons Inflate the balloon by blowing air into it Close the glass tube with a stop cock so that the air does not escape Now tie the second balloon at the other end of the glass tube Open the stop cock (Fig 2 16) What do you observe?

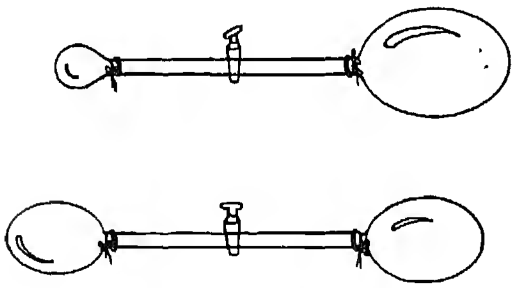


Fig. 2.16

You will find that the air from the inflated balloon goes to the other balloon and inflates it. The shape of the air changes according to the shape of the balloon. The volume of air also changes

You must have experienced that when firewood or cow dung is burnt, you smell it even outside the house. When you light an *agarbatti,* you smell it in any corner of the room. It means that the molecules of gases move easily

ANSWER THESE

1. In solids, the molecules are ________ packed.
2. The molecules are at a greater distance in ________ as compared to liquids
3. When someone opens a bottle of perfume, you smell it from a distance Why is it so?

YOU NOW KNOW

— Grouping of objects is useful in understanding and using them

— Classification of a variety of things you see around is done on the basis of their similarities and dissimilarities

— Things can be grouped on the basis of their colour, size, shape, hardness, texture, etc. They can also be classified as living and non-living.

— All objects are made up of one or more materials. Many materials occur in nature. Many are man-made.

— Anything which has mass and occupies space, is matter.

— Matter may exist in three different states—solid, liquid and gaseous.

— Matter can be changed from one state to another

— Materials can be classified on the basis of some of their characteristics, such as state, solubility, heaviness, magnetic behaviour, etc.

— There are ninety-two naturally occurring elements found on the earth. A few more are man-made.

— Most of the elements occur in nature in the combined form
— Substances that consist of two or more elements combined together are called compounds
— The properties of a compound are different from those of the combining elements
— In a mixture, substances which are mixed, retain their own properties
— Some elements are metals and some are non-metals
— All the atoms of an element are identical but the atoms of different elements are different
— All the molecules of an element or a compound are identical but the molecules of different elements and compounds are different.
— An element is made up of only one kind of atoms
— A molecule of a compound can be broken further into atoms of the constituent elements.
— An atom or a molecule is so small that it cannot be seen even with a powerful microscope.
— In solids, particles (atom/molecules) are closely packed whereas in liquids particles are loosely packed They have space between them to move In gases particles are far apart
— Solids have definite shape and volume Liquids have fixed volume; they do not have fixed shape They take the shape of the container in which they are kept. Their volume does not change. Gases do not have a fixed shape and volume They fill their container completely

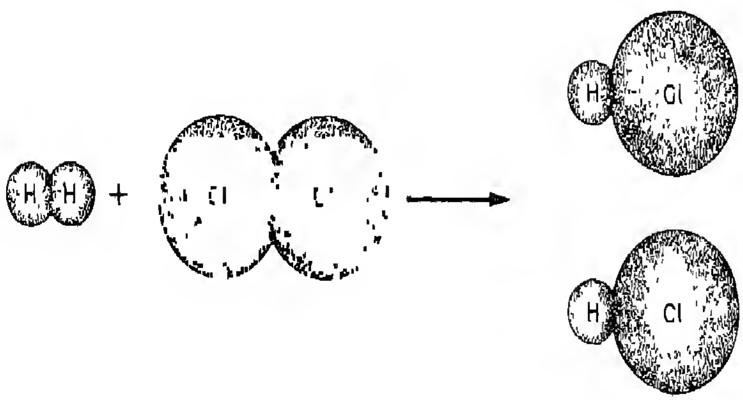
Now Answer These

1 Why does a glass of water feel heavier than a glass without water?
2 Why are gases compressed more easily than solids or liquids?
3 Name five liquids that you can find in your home
4 Tick the right answer
   (i) A gas in a container will
      (a) spread out along the bottom of the container
      (b) spread out all through the container.
      (c) will not spread out at all
      (d) spread out only at the top of the container
   (ii) A compound is a combination of elements
      (a) that can be separated easily
      (b) in which the elements retain their properties
      (c) in which the elements lose their properties.
5. Which of the following substances are elements?
   water, salt, mercury, iron, wood nitrogen, hydrogen, oxygen, sugar, chlorine
6. Which of the following elements is a non-metal?
   (i) Copper
   (ii) Mercury

(iii) Aluminium
(iv) Sulphur

7 Give two properties of metals.

8. Fill in the blanks
(i) _________ retain their shape
(ii) Molecules in a solid are _________together.
(iii) _________ are building units of a material
(iv) Elements are made up of very small particles called _____
(v) All atoms of an element are_____
(vi) A molecule of a gaseous element mainly consists of _________ atoms.
(vii) A molecule of a _________ is made up of atoms of two or more elements



Separation of Substances

THE WORLD AROUND YOU is full of a variety of materials such as air, soil, rocks, sea water, milk, flowers and fruits All these materials consist of more than one substance. They are examples of mixtures

What is a mixture made of? Why do you separate the components of a mixture? What different methods are used to separate the components of a mixture? Let us learn the answers to these questions in this unit

3.1 *What is a Mixture?*

You have already learnt about a mixture of sulphur and iron You found that in the mixture the components, that is, sulphur and iron, retained their properties. They could be separated easily. The quantities of iron and sulphur in the mixture was not fixed Let us study some other mixture

In Fig 3 1, both the glass tumblers have solids in them Mix the solids of both the tumblers in another tumbler. Now you have a mixture of solids

During summer you often take *sharbat* which is a mixture of sugar and water

A cup of tea or coffee is also a mixture of several components (Fig. 3 2)

All elements and compounds are pure substances All pure substances

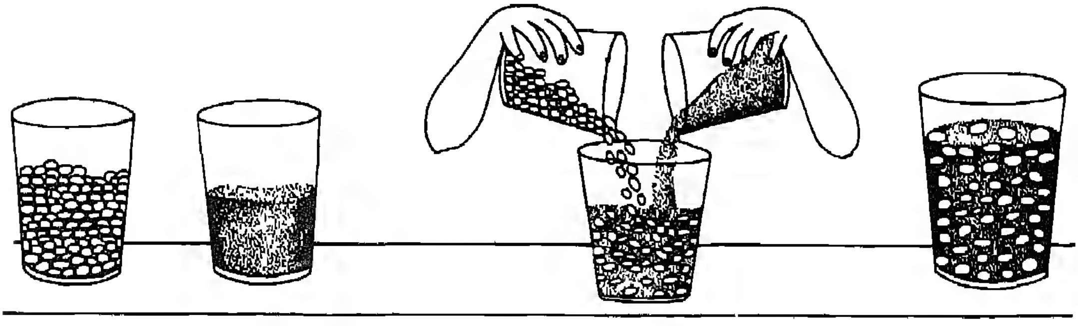


Fig. 3.1

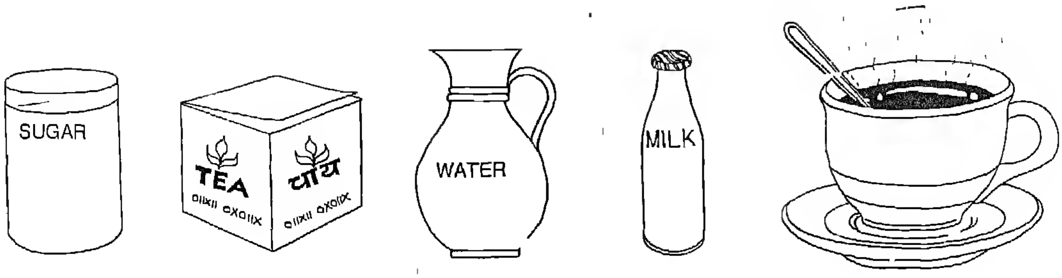


Fig 3.2

contain same kind of molecules For example, all molecules in a sample of common salt are of the same kind Sugar contains molecules of another kind But rock salt is a mixture of salt and soil or sand It is an impure substance

Sometimes, different substances present in a mixture can be easily seen For example, in a heap of wheat, you often see some barley grains, small pieces of stones and husk But many mixtures, such as milk, grass, sea water, jaggery *(gur)*, appear as if they contain only one substance. In fact, they contain several substances It can be shown that these are mixtures You can easily separate some of the substances present in them.

To find whether a substance is pure or impure, you have to *examine* its *characteristic* properties A pure substance has its own set of properties, such as fixed melting and boiling points These properties will be different for different pure substances For example, the properties of sugar, such as taste, ability to dissolve in water, are different from those of common salt. In a sample of impure substance, some of the properties of the pure substance like colour, taste, boiling point, melting point, etc, may change For example, water boils at 100 °C If some common salt is mixed in it, the resulting solution boils at a higher temperature

The mixture could be a solid, a liquid or a gas Pond water is a mixture containing various *impurities.* In what respect is pond water different from tap, well or sea water?

Sea water looks as if it is one substance It is a mixture of several salts dissolved in water Common salt used in cooking is obtained from sea water The water of certain lakes, like Sambhar lake in Rajasthan, also contains common salt

Soil is a mixture of sand, clay and various salts and remains of plants and animals

If you examine a piece of rock, you will see different colours and particles of different sizes Thus rock is a mixture of various types of substances.

The air around you is a mixture of different gases, such as oxygen, nitrogen,

carbon dioxide, water vapours and dust particles

Most of the materials obtained from plants and animals are mixtures Milk is a mixture You can see cream floating on milk when you cool it after boiling

Sugarcane juice is a mixture of sugar, water and many other substances On evaporating water from sugarcane juice, you get jaggery, which is also a mixture

From the above examples, you will realise that a mixture is made up of two or more substances The substances in a mixture retain their properties

It is possible to separate from a mixture one or more useful components

You might have seen the people separating small pieces of stones and insects from wheat, rice and pulses before using them You peel off the skin of a banana before eating it. You separate tea leaves to get a tea extract before drinking it Butter is separated from milk These are some examples in which you separate one or two components from a mixture

Separation of the components of a mixture is done for various purposes, such as:

(i) to remove an undesirable component

(ii) to remove a harmful component

(iii) to obtain a pure sample of a substance.

(iv) to obtain a useful component

ANSWER THESE

1. Name two pure substances that you know
2. Name three mixtures commonly found in nature
3. Name the components in the following mixtures
   pond water, milk, sugarcane juice, soil
4. Which of the following is a mixture? salt, air, tap water, alum powder, sugar
5. Name two commonly known mixtures the components of which are useful after separation.

3.2 *Methods of Separation*

You have seen that many materials around you are mixtures For daily use in homes and industries, one or more components of these mixtures may be required These components can be obtained by separating them from their mixtures The method of separation depends upon the characteristic property of the substances to be separated Therefore, when you wish to separate the components of a mixture, first try to find out some properties which would be different for different components. Now, you will study some methods commonly used for separating the components of a mixture.

WINNOWING

You must have seen a farmer separating wheat grains from the husk in a field

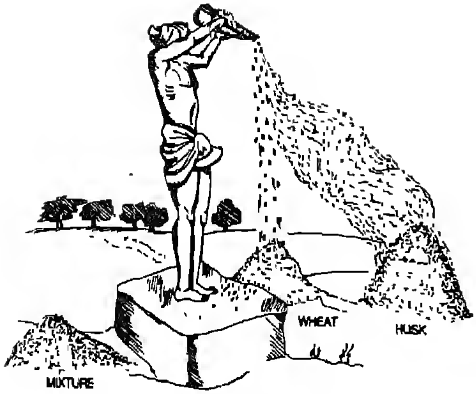


Fig 3.3 *Winnowing*

The farmer allows the mixture of wheat and husk to fall down from a height The wind carries the lighter husk with it The wheat grains being heavier fall vertically down to the ground. The husk forms a heap at a small distance away from the heap of wheat (Fig. 3.3).

You must have also seen people at home or at the flour mill *(atta chakki)* separating the lighter components from wheat or rice

HANDPICKING

Hand-picking is usually done to separate undesirable substances such as small pieces of stone from wheat, rice and pulses This method is used only when one of the components is there in a small quantity (Fig. 3.4)

SIEVING

This method is used to separate the components of a mixture which are of different sizes You must have noticed that undesirable materials are separated from the grains by using a sieve

You must have also noticed that flour is sieved for different purposes (Fig 3 5) In these cases, sieves of different sizes of holes are used The size of the holes of the sieve to be used depends upon the size of the particles of the material to be separated

Fine sand can also be separated from larger particles by sieving. (Fig 3 6)

This method can also be used to separate similar objects of different sizes. For example, cashewnuts of different sizes are separated in cashewnut factories Jewellers also separate pearls

Fig. 3.4 *Hand-picking*

Fig. 3.5 *Sieving of flour*

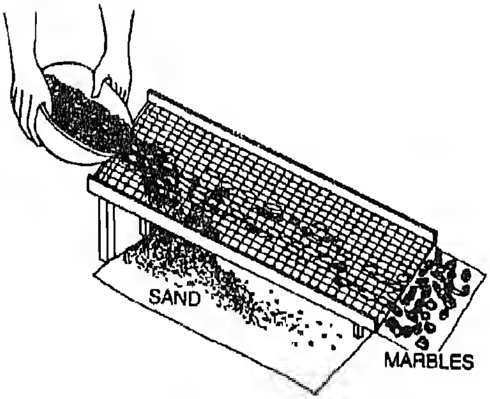


Fig. 3.6 *Sieving of sand*

of different sizes by sieving. This method is used for separating the solid components of a mixture.

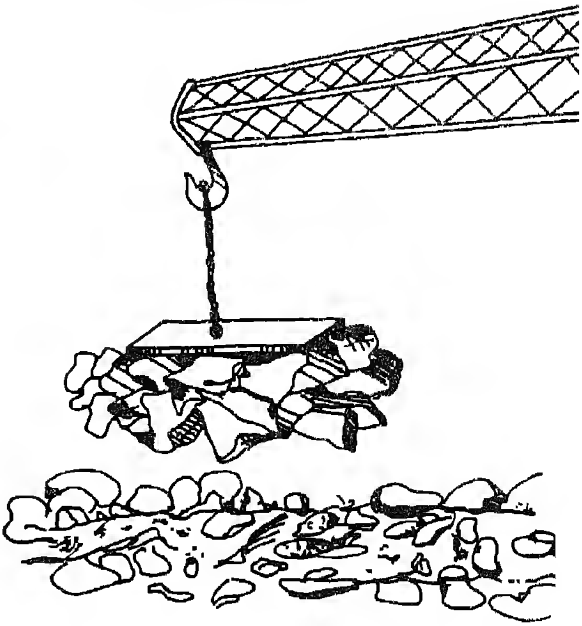
MAGNETIC SEPARATION

You have already learnt that iron is attracted by a magnet. This behaviour of iron towards the magnet is used to separate iron from a mixture. You have already seen that iron is separated from a mixture of iron powder and sulphur by using a magnet. In industries, impurity of iron in several substances is removed by the use of magnets. In many factories, scrap iron is separated from the heap of waste materials by using big electro-magnets fitted to a crane (Fig. 3.7)

DECANTATION

Solids which are insoluble in liquids can be separated by decantation. For, example, sand and water can be separated from their mixture by this

Fig. 3.7 *Separation of scrap iron from the heap of waste materials*



method. To do this, allow the mixture to stand in a container for some time You will see that the sand will settle at the bottom of the container. This is called *sedimentation* Pour the top layer of water gently into another container See that the sand is not disturbed (Fig. 3 8). This process is called *decantation.* Similarly, before cooking, rice and pulses are washed with water. The water is separated by decantation

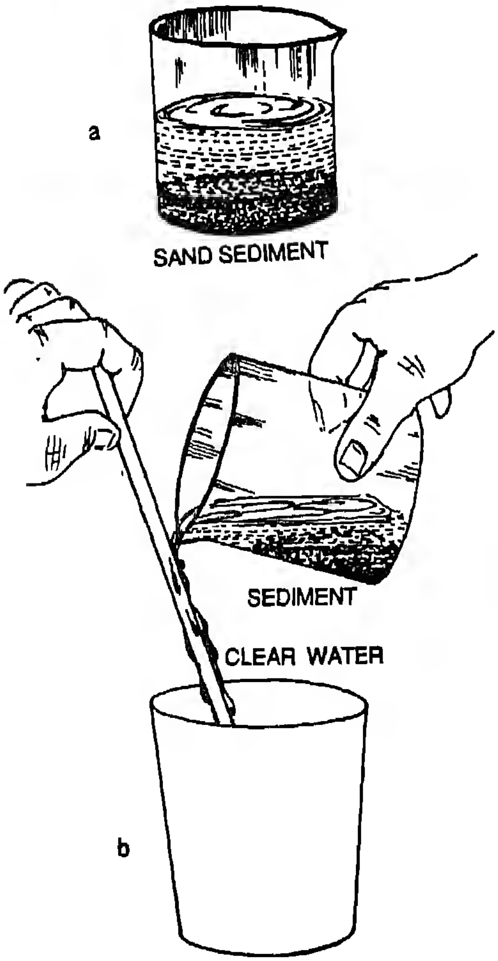


Fig. 3.8 ***(a) Sedimentation***
(b) Decantation

The process of decantation can also be used for separating two immiscible liquids such as water and oil

This method cannot be used if a solid dissolves in a liquid or two liquids are miscible For example, the components of a mixture of sugar and water or a mixture of kerosene and petrol cannot be separated by this method

You can also make use of a simple device known as a separating funnel to separate immiscible liquids Immiscible liquids form distinct layers The liquid forming the lower layer can be drained off by opening the stop cock of the funnel A burette may be used instead of a separating funnel for this purpose. This method of separation is based on the property that one of the components of the mixture is heavier than the other.

To understand which of the two methods i.e. decantation or the use of a separating funnel is better, let us perform the following activity.

Activity 1

Separate water and kerosene from their mixture by decantation and by using a separating funnel. Which component will form the upper layer? (Fig. 3.9)

You will find that kerosene forms the upper layer. On opening the stop-cock water will drain off. You will observe that only a small quantity of the mixture remains unseparated

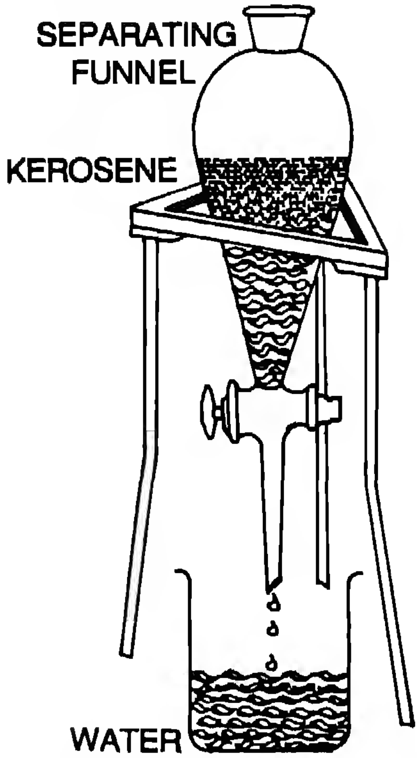


Fig 3.9 *Separation of two immiscible liquids*

LOADING

Sometimes water from a river, pond or lake is muddy. This means that it contains very fine suspended clay particles If you want to separate clear water by decantation, it will take a very long time for the clay particles to settle down To make the process of settling faster, the method of loading is used. Loading is done by using a piece of alum (Fig 3 10). Loading helps the clay particles to settle down rapidly

Alum dissolves in water very easily The dissolved particles of alum load the fine clay particles and they (clay particles) become heavier and settle down The clear water is then decanted

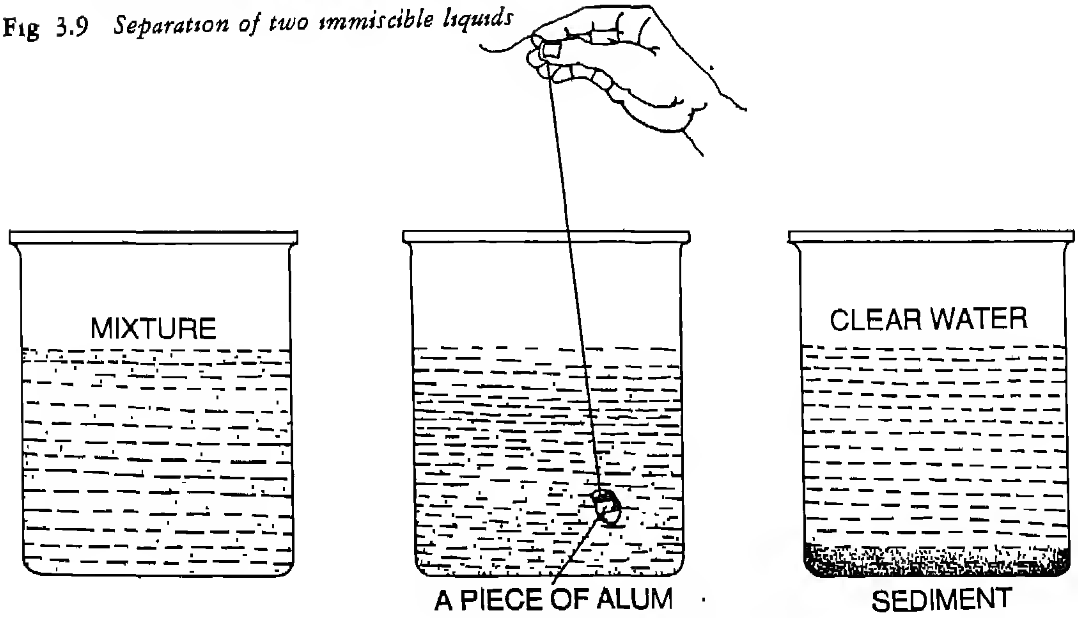


Fig. 3.10 *Loading of suspended clay particles with alum*

It is common experience that after the first rain the dust particles hanging in the air settle down This happens because the rain drops load the dust particles Thus, the dust particles get separated from the air.

CENTRIFUGATION

Centrifugation is a method for separating the suspended particles of a substance in a liquid In this method the mixture containing fine suspended particles is rotated in a closed bottle. The heavier material moves towards the bottom of the bottle The lighter material remains on the top

By this method you can separate clay particles suspended in water The clay particles being heavier settle at the bottom. Separation would be better if the bottle (container) is rotated at a very high speed The process of centrifugation is widely used in dairies to separate cream from milk Milk is rotated at a very fast speed in a closed container Cream collects in the centre and being lighter than milk floats at the top of the mixture.

FILTRATION

When you make tea, you separate the tea leaves from the liquid by using a filter such as a wire mesh (strainer) or a piece of cloth The tea leaves are retained on the filter (Fig. 3.11). This process of separation is called *filtration.*

Fig. 3.11 *Separation of tea leaves by using a tea-strainer*

By this method, insoluble solids of various sizes are separated from the liquids by using a filter. To separate small particles you would need a filter with small holes. A piece of cotton, a layer of sand, a piece of filter paper, or a piece of muslin cloth can be used as filters.

In cities gutter water is filtered through big metallic filters in order to retain solid materials and avoid choking of drains. Drinking-water is filtered through a special filter which removes bacteria. Can you filter turbid water through a tea-strainer?

EVAPORATION

How will you separate common salt dissolved in water?

A simple method is to remove water by keeping the solution in the sun The water slowly evaporates leaving behind the common salt in the container (Fig 3 12)

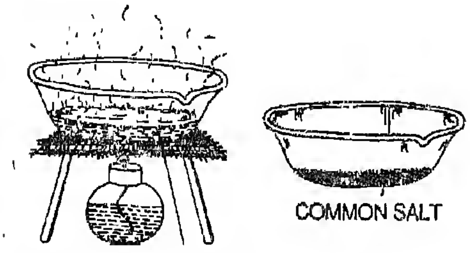


Fig. 3.12

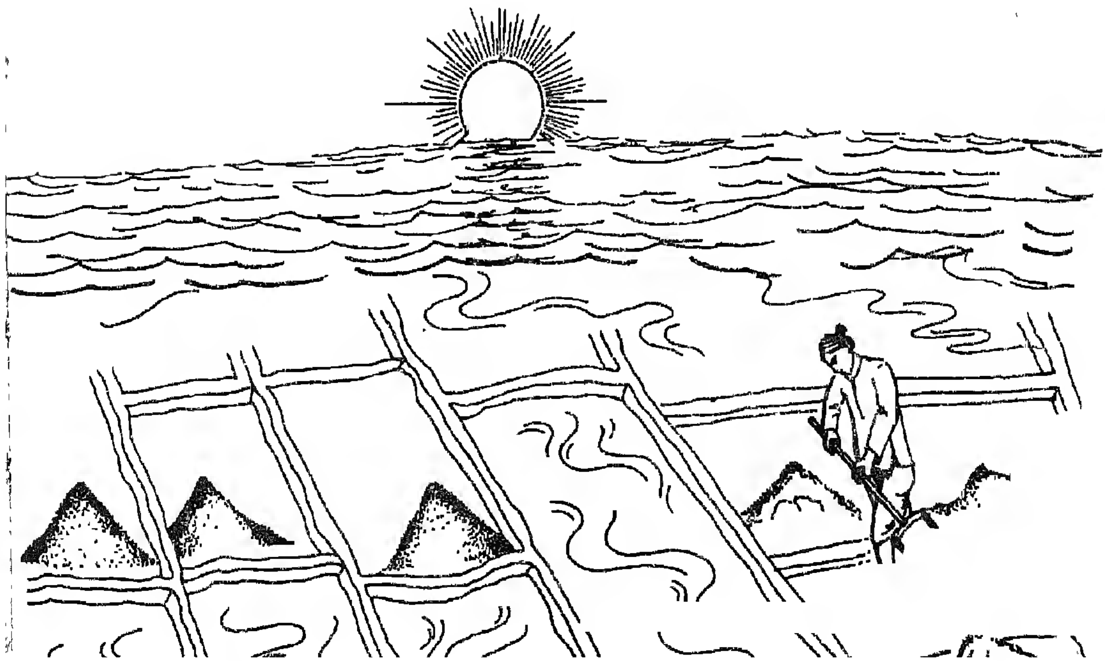
In fact, this process is used on a large scale to obtain common salt from sea water or lake water containing common salt (Fig 3 13)

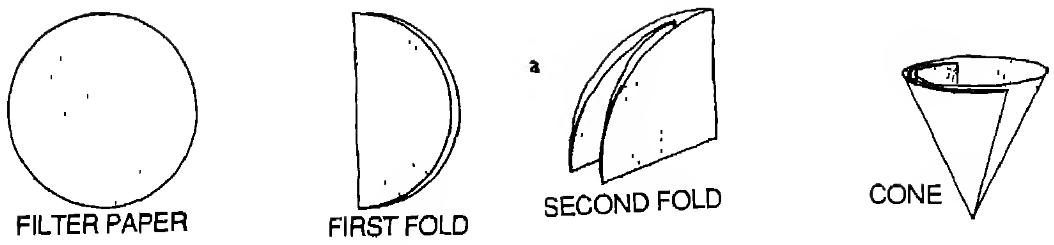
This method is used to separate solids dissolved in a liquid. Evaporation can be made quicker by heating the solution

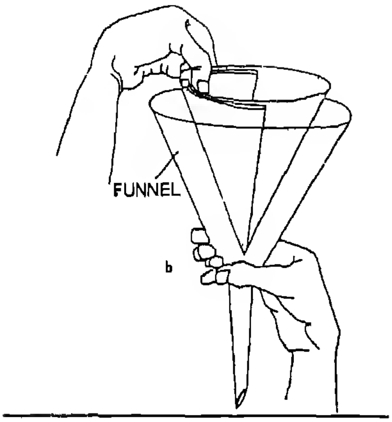
CRYSTALLIZATION

The process of crystallization is used for getting a pure sample of a soluble solid substance from the solution To get the pure sample as much quantity as possible of the substance is dissolved in a hot liquid. The solution is then filtered to remove insoluble impurities. On cooling, the hot solution gives crystals of the pure solid

Fig. 3.13 *Preparation of salt by evaporation of water*







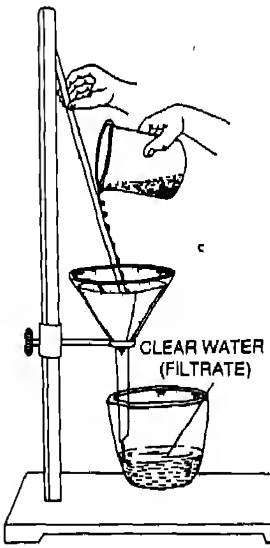


Fig 3.14
(a) Folding of filter paper
(b) Fitting the folded filter paper in a funnel
(c) Filtration through the folded filter paper

Activity 2
Take a beaker and fill it about half with water Add some alum powder in it and heat the solution. Continue adding alum powder till it stops dissolving Filter the hot solution into a glass tumbler using filter paper (Fig 3.14) Allow the tumbler to cool Observe the solution

You will see the crystals of pure alum in the tumbler If you want to grow a big crystal of alum, hang a small seed-like crystal of alum in this solution with the help of thread (Fig. 3.15) After two

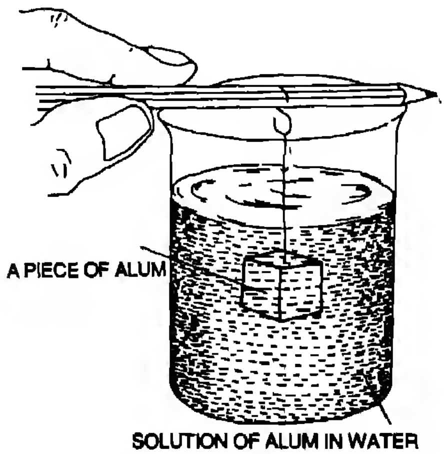


Fig. 3.15 *Growth of a big crystal of alum*

or three days, you will see a big crystal of alum.

Different substances give crystals of different shapes and colours

SUBLIMATION

Sublimation is a method for separating those substances from a mixture which on heating directly go into the gaseous form The gaseous form of the substance is cooled to get the pure solid Examples of the solids which sublime on heating are. camphor, ammonium chloride *(naushadar)*, iodine If you want to separate common salt and ammonium chloride from a mixture, perform the following activity

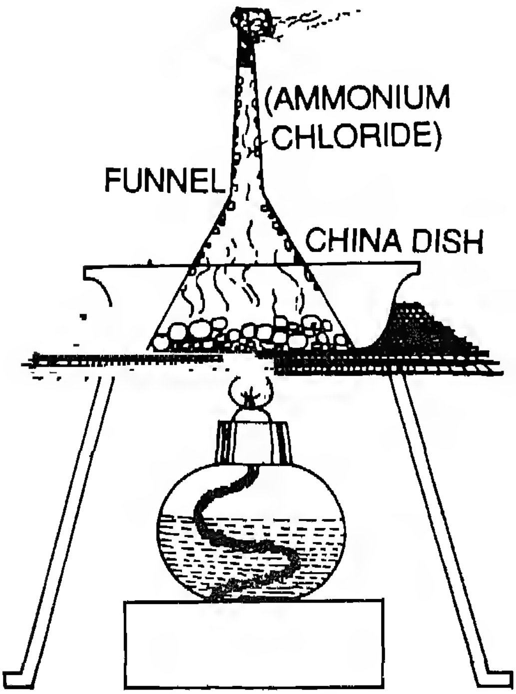


Fig. 3.16 *Sublimation*

Activity 3

Take a half-teaspoonful each of ammonium chloride and common salt in a china dish or a tin plate Keep it over a tripod stand. Cover the china dish with an inverted glass funnel (Fig 3 16).

Heat the china dish till white fumes start coming out of the mixture Plug the opening of the funnel with a piece of cotton Stop heating. Allow it to cool. Remove the funnel and observe its inner side You will find white pure ammonium chloride deposited on it Salt is left behind in the china dish Sublimation process is used for separating the substances which sublime

Separation of salt and camphor from a mixture can be done in two ways: (i) by dissolving and filtering, and (ii) by sublimation.

DISTILLATION

Doctors use pure water for dissolving medicines for injections Have you ever thought how pure water is obtained? It is obtained by distillation of water. Distillation is a process of obtaining a pure liquid from a solution In the process of distillation, the solution is heated in order to vaporize the liquid The vapours of the liquid are cooled to get pure liquid. This process is also used to separate two liquids which are miscible (soluble) and which boil at different temperatures For example, alcohol boils at 80°C and water boils at

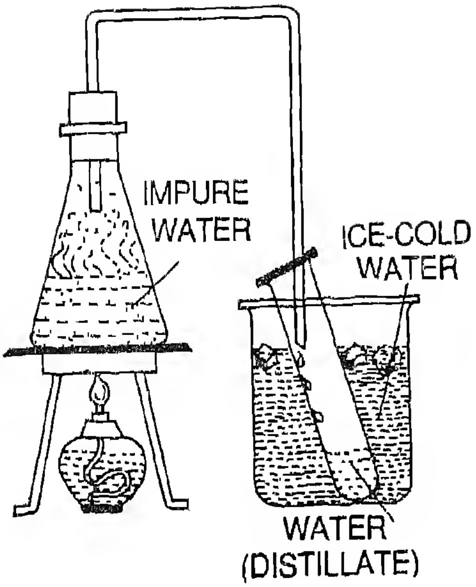


Fig 3.17 *Distillation of water*

100°C If a mixture of alcohol and water is heated, the alcohol boils first and distils over. The water is left behind

Activity 4

To get distilled water, set up an apparatus as shown in Fig 3.17. Heat the conical flask containing tap water and a crystal of potassium permanganate Observe water vapours rising in the conical flask and going into the bent glass tube. Observe the water drops falling into the test-tube kept in a beaker of cold water Is this sample of water coloured? No, it is not. This is distilled water, a pure sample of water

ANSWER THESE

1 Name five methods of separating various components from a mixture.
2 How will you separate groundnut oil from water?
3 How will you separate pure water from a solution of salt in water?
4 Name the methods by which you can separate camphor from salt.
5. Describe the method to obtain pure salt from rock salt.

3.3 *Separation of a Pure Material from a Mixture by using a Combination of Various Methods*

Very often pure substances are obtained by using a combination of several methods of separation For example, common salt obtained from sea water is purified by a combination of various methods It is crushed, dissolved in water, filtered, evaporated and then crystallized to get pure salt. (Fig 3 18)

Perform the following activities·

(i) Separate iron filings, ammonium chloride and sand from their mixture
(ii) Separate sugar, kerosene and water from their mixture

From these activities you will realize that to separate different components of a mixture you may have to use a combination of various methods.

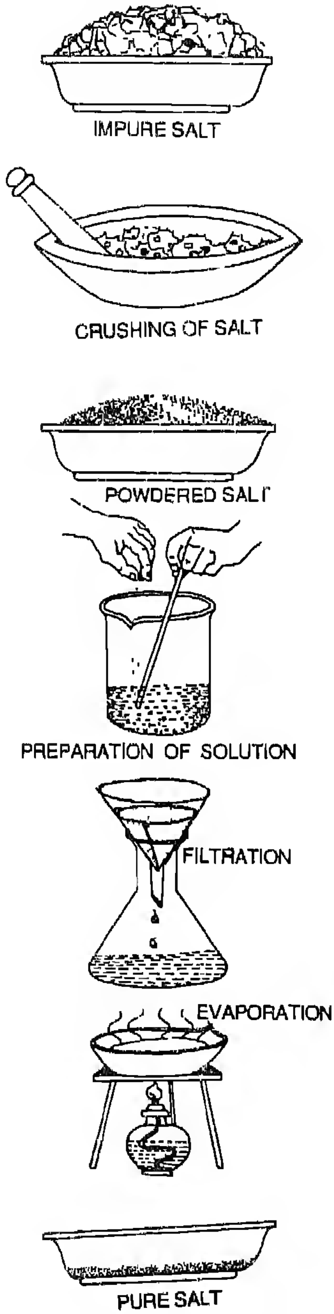


Fig 3.18 *Separation of pure salt from a mixture.*

Answer These

1. How will you separate common salt, sand and iron filings from their mixture?
2. A mixture of iron filings and sulphur powder is given. How will you separate them from the mixture?
3. Describe a method of separating common salt from a mixture of common salt and chalk powder.
4. You are given a mixture of sand, water and mustard oil. How will you separate the components of the mixture?

YOU NOW KNOW

— A pure substance is made up of only one kind of molecules

— The purity of a substance is determined by its melting-point and boiling-point

— The differences in the properties of substances are used to separate them from a mixture.

— Selection of a method depends upon the nature of the component to be separated

— Separation of the components of a mixture is done to remove an undesirable component or to get a desirable component

— One component or all the components of a mixture may be useful

— The components of a mixture are separated by one method or a combination of various methods

— Various methods such as sedimentation and decantation, filtration, sieving, hand-picking, magnetic separation, loading, winnowing, evaporation, crystallization, sublimation, centrifugation and distillation are used to separate various components present in a mixture.

Now Answer These

1. A mixture of ammonium chloride and sand is separated by
   - (i) Evaporation
   - (ii) Decantation
   - (iii) Filtration
   - (iv) Sublimation
2. How will you separate iodine and salt from a mixture?
3. How will you separate the following?
   - (i) Water from mustard oil
   - (ii) Cream from milk
4. Describe the various steps involved in the separation of iodine, iron filings and salt from a mixture
5. Select the suitable word from the words given below and fill in the blanks

   sublimation, winnowing, hand-picking, centrifugation, filtration, evaporation, separating funnel, distillation

   - (i) Cream is separated from milk by ____________ .
   - (ii) Camphor is separated from common salt by ________ .
   - (iii) Pure crystals of common salt are obtained by ____________ and crystallization
   - (iv) Two immiscible liquids are separated by using ______
   - (v) Peanuts are separated from a mixture of wheat and peanuts by ____________
   - (vi) ____________ is used to separate husk from wheat
   - (vii) Pure liquid is obtained from the solution of a salt in the liquid by ____________
6. A solid substance is dissolved in water. Which one of the following methods is used to separate it?
   - (i) Filtration
   - (ii) Evaporation
   - (iii) Sublimation
   - (iv) Decantation
7. Which method would you use for separating a solid substance dissolved in water? Both the components are to be collected.
8. Write 'T' if the statement is true and 'F' if it is false.
   - (i) Rock salt is an impure substance.
   - (ii) The process of winnowing is used to remove small stone particles from wheat.
   - (iii) A pure sample of a substance consists of only one kind of molecules
   - (iv) Common salt is separated from its solution in water by decantation
   - (v) Cream is separated from milk by sieving

UNIT FOUR

Measurement

MEASUREMENT IS one of the most useful processes in science and in our daily life. Without actual measurement you cannot make correct judgement about a given object. It is not always easy to find out the length, area, volume, or mass of different objects by just looking at them. Your senses may misinform you at times. You cannot always trust your guess work. Actual measurement makes your judgement more dependable.

Look at the two lines given in Fig 4.2. Which line is longer?

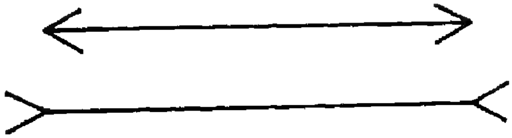


Fig. 4.2 *Are these two lines equal?*

Look at the two flowers shown in Fig. 4.3 Which one of the inner circles is bigger?

Fig. 4.1 *What is wrong with the measurements?*

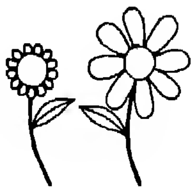


Fig. 4.3 *Are the inner circles in these flowers equal?*

Look at the two measuring cylinders (Fig. 4.4). Which cylinder has more water?

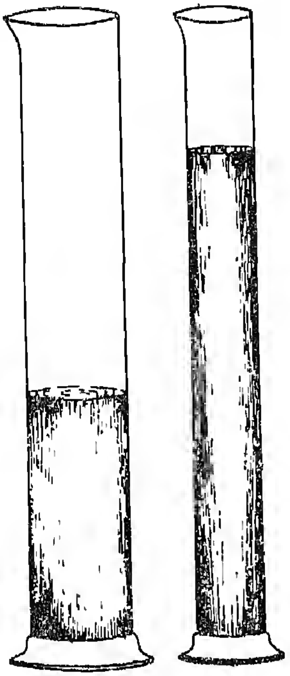


Fig. 4.4 *Is the volume of liquid in these cylinders equal?*

4.1 *Need of Standard Units*

A variety of objects can be used for the same measurement. For example, to measure length, you may use a foot step, arm length (cubit), handspan, etc. Here (Fig. 4.5) the length of each of these items is a unit of measurement.

Suppose you choose to measure the width of your classroom window with the help of your handspan. If it is equal to the length of three handspans, you will say that the width of the window is equal to three handspans.

Thus, the length of one handspan of your hand is a unit of length in this case. Ask three of your classmates to measure the width of the same window with their handspans. Compare these lengths. Are they equal? If they are not, can you give reason for the difference? The length of your handspan and that of your classmates' may be different. So when you tell others about the measurement made by you, using your handspan, they will not be able to understand how much

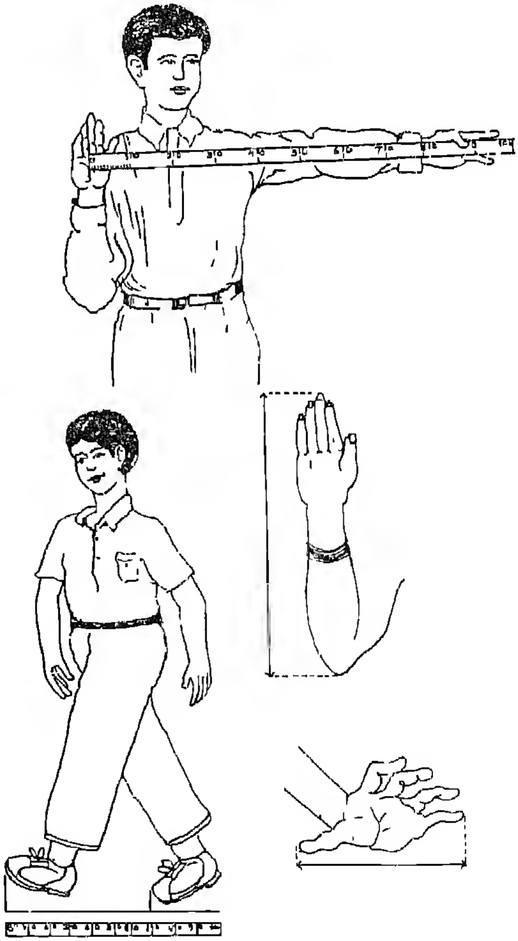


Fig. 4.5 *Some units of measurement*

the actual length is. It is because they do not know the length of your handspan Therefore, handspan is not a proper unit of measurement Similarly, the lengths of other body parts are different for different people So these cannot be used as a common unit of measurement. Likewise for measuring milk you cannot use your *katori* or tumbler as a unit

For the sake of uniformity, common units of measurement are necessary. Hence, in buying and selling in the market a common unit of measurement is used.

The unit which people agree to use as a basic unit of measurement becomes a standard unit for that group of people For the sake of uniformity, scientists all over the world have accepted following standard units for measuring different quantities

> The standard unit of *length* is *metre.*
> The standard unit of *mass* is *kilogram.*
> The standard unit for *time* is *second*

Table 4.1 gives the units of length, mass and time

TABLE 4 1
Units of Length, Mass and Time

Length
10 millimetres (mm) = 1 centimetre (cm)
100 cm = 1 metre (m)
1000 m = 1 kilometre (km)
Mass
1000 milligrams (mg) = 1 gram (g)
1000 g = 1 kilogram (kg)
100 kg = 1 quintal
10 quintals = 1 metric ton
Time
60 seconds (s) = 1 minute (min)
60 min = 1 hour (h)
24 h = 1 day
365 days = 1 year

4.2 *Measurement of Length*

Metre is used as a standard unit for measuring length. 'Metre' is written as 'm' in short form Do you know how long a metre is? The door of a room in a house is generally about one metre wide

Metre can be used as a unit to measure the length of a room, the height of a tree or of a building or the length and breadth of a playground. Now suppose you want to measure the length of your pencil or your notebook Since the length of these objects are much less than a metre, it will be convenient to express it in smaller units Centimetre is such a unit

1 metre (m) = 100 centimetres (cm)

The thickness of a coin, or a thin wire is much smaller than a centimetre. So you will need a still smaller unit. Such small lengths can be expressed in the unit of millimetre

1 centimetre (cm) = 10 millimetres (mm)

1 metre (m) = 1000 millimetres (mm)

Now suppose you want to measure the distance between two cities or villages Metre will not be a convenient unit to express such large distances. Here a larger unit of length is needed. This unit is called kilometre.

1 kilometre (km) = 1000 metres (m)

When you measure the width, height or depth, you follow the same process. In fact when you measure width, height or depth you measure the length.

Various types of measuring devices such as a ruler, a measuring-tape, etc., are used by different people for different purposes to measure length. While measuring the length of an object you must choose a proper measuring device. The choice of the device generally depends upon the object to be measured. For example, for measuring small lengths you should choose measuring instruments marked in centimetre If you are to measure the girth of a tree you have to use a measuring-tape because it can be bent What does a tailor use to measure your chest?

PROPER USE OF INSTRUMENT

You have to take certain precautions while using devices for measuring length If these precautions are not taken, your measurements may be wrong The precautions are·

(i) The scale should be placed along the length to be measured (Fig 4.6) It should also be placed very close to the object to be measured.

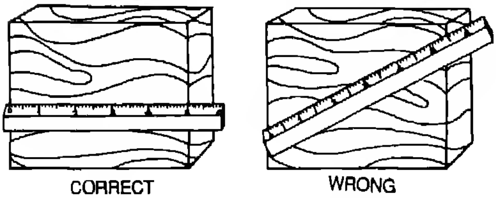


Fig. 4.6 *Proper placement of the scale along the length to be measured*

(ii) In some scales the ends may be broken or you may not be able to see the zero mark clearly In such cases, you should use any other full mark of the scale (Fig. 4 7).

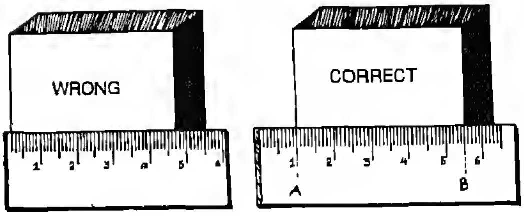


Fig 4.7 *Proper placement of the scale with broken edges*

Then you must subtract the reading of this full mark from the reading at the other end For example, in Fig. 4.7 the reading at one end is 1 0 cm and at the other end it is 5 5 cm Therefore, the length of the object is 5 5—1 0=4 5 cm and not 5 5 cm

(iii) Your eye must be exactly above the point where the measurement is to be taken as shown in Fig. 4 8 from position A. Note that from position A the reading is 1 0 cm From positions B and C, the readings are 0 9 cm and 1.1 cm, respectively. The readings from B and C are not correct

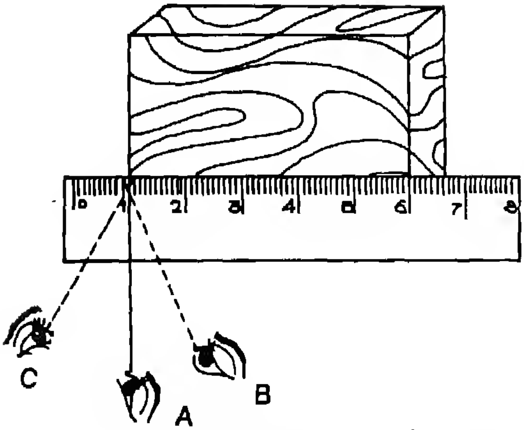


Fig. 4.8 *Position of the eye for the proper reading of the scale*

BEWARE BEFORE YOU BUY

There are many things such as cloth, pipe, laces, which are sold by the length. When you go to buy them, you must ensure that the metre scale used is correct A correct metre scale [Fig 4 9(a)] has signs (⟵ ⟶) on both ends in addition to the stamp of the Weights and Measure Department. An incorrect metre scale [Fig. 4.9 (b)] may not have

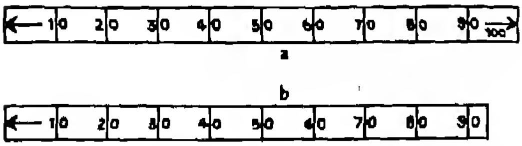


Fig. 4 9 *(a) Correct metre scale used in the market*
(b) Incorrect metre scale

arrow sign on one or both sides. It may be that the metre has been cut off. This results in short measurement You must insist on correct measures You must also ensure that the metre scale has a stamp of the Weights and Measure Department. You may go to the market to find out whether correct metre scales are being used or not

MEASURING DIAMETER OF SPHERICAL SURFACES

Can you measure the diameter of a ball with the help of a metre scale? Even a measuring tape cannot be used to measure the diameter correctly One of the ways in which the diameter of such round objects can be measured easily is as shown in Fig. 4 10 Use this method to find out the diameters of a one-rupee coin and a fifty-paisa coin

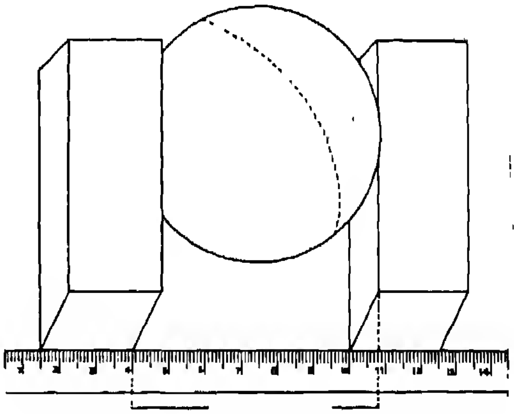


Fig. 4 10 *Measuring the diameter of a ball*

MEASURING SMALL THICKNESS

If you want to measure the thickness of a coin, or of a playing-card or of a thin wire, you cannot use a metre scale directly. Suppose you want to measure the thickness of a coin. First prepare a stack of 10 similar coins. Measure the thickness of this stack by using your scale as shown in Fig.4.11.

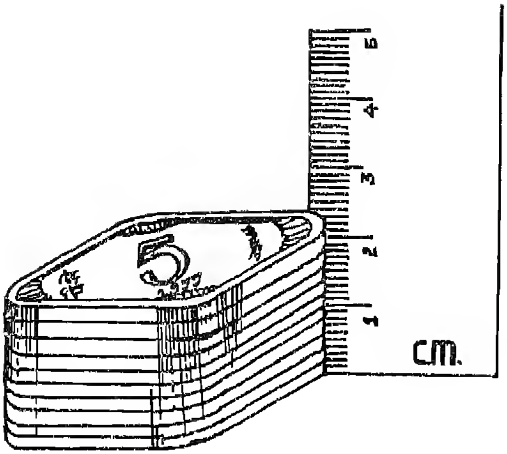


Fig. 4.11 *Measuring the thickness of a five-paisa coin*

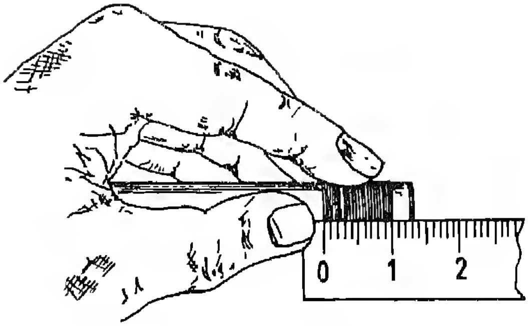


Fig. 4.12 *Measuring the thickness (diameter) of a wire*

Divide this thickness by 10 (the number of coins in the stack). This way you get the thickness of one coin. Similarly, you can find out the thickness of a sheet of paper or of a playing-card

You can determine the thickness of a thin wire as shown in Fig 4 12 .Wrap, say, 25 turns of the wire on a round pencil. See that the turns are closely wrapped one after the other. The wire so wound forms what is called a coil Measure the length of the coil with the help of a scale The thickness of the wire can be found by dividing the length of the coil by the number of turns

ESTIMATION

In your daily life, you often need to estimate the length of various objects. In many cases actual measurement may be neither possible nor desirable But you have to estimate To make correct estimates, you need a thorough practice Try to estimate the following lengths and check your estimates by actual measurements Record your observations in Table 4 2 If your estimates are not up to the mark, keep on practising

TABLE 4 2

Estimated and Actual Lengths of Some Objects

S. No.	*Objects*	*Estimated Length*	*Actual Length*
1.	Length of classroom		
2	Height of your teacher		
3	Breadth of your blackboard		
4	Girth of a tree		

ANSWER THESE

1. Handspan and cubit cannot be used as standard units of length. Why?
2. Which of the following is a standard unit of length?
   (a) decimetre (b) centimetre (c) millimetre (d) metre
3. Describe the method you would use to find the thickness of a sheet of paper of your science book
4. What type of scale would you use to measure your chest?
5. State the precautions which should be taken while using a metre scale to measure length.

4.3 *Measurement of Area*

You have learnt in your mathematics course that area is the measure of surface of an object. You have also learnt in that course the method to determine the area of regular objects. The standard unit of area is metre^2 written as m^2. To express area of a small object such as a book, newspaper or a towel, the convenient unit is cm^2.

The area of still smaller objects can be conveniently expressed in the unit of mm^2

To express larger areas such as the area of a field or that of a country, the convenient units are 'are' and 'hectare'

1 are = 100 m^2

1 hectare = 100 are = 10000 m^2

Activity 1

Measure the area of objects given in Table 4 3.

AREA OF IRREGULAR SURFACE

Objects such as a leaf or a feather do not have a regular shape like a rectangle or a triangle These cannot be measured correctly. They are irregular objects. Therefore, the method employed to find the area of a regular surface cannot be

TABLE 4 3

Area of Some Regular Objects

S No.	*Objects*	*Length*	*Breadth*	*Area = length × breadth*
1	Classroom floor			
2	One page of a newspaper			
3	Science textbook			
4	Classroom window			

used to find the area of irregular surfaces The area of irregular surfaces can be found to a good approximation by using a graph paper

Suppose you want to find the area of a leaf. Place the leaf on a graph paper and mark its boundary (Fig.4.13). Then count

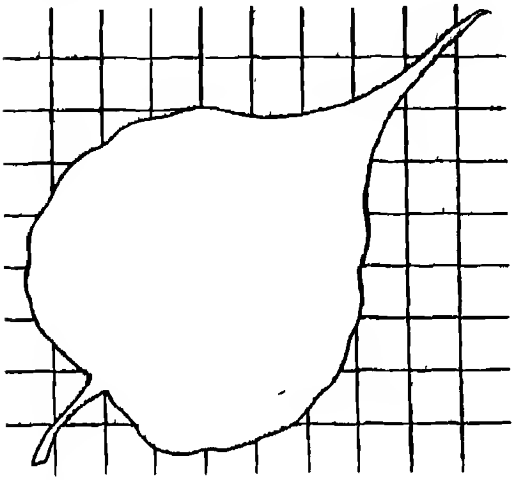


Fig. 4.13 *Measuring the surface area of a leaf*

the number of complete squares inside the boundary Also count those squares which are half and greater than half inside the boundary. Add this to the number of complete squares. Neglect those squares which are less than half inside the boundary Find out the area of one square Multiply this by the total number of squares It is the approximate area of the leaf In this way, find out the area of a ten-paisa coin and the sole of your slipper

ESTIMATION OF AREA

You already know the importance of estimation Estimate the area of your palm, a door, and a blackboard Verify your estimates by actual measurements

ANSWER THESE

1. The length of a rectangular field is 55m and its breadth is 40m Calculate its area in 'are' and 'hectare'
2. If the area of a rectangular sheet of metal is 450 cm^2 and its length is 25cm, calculate its breadth
3. A man wanted 200 tiles of the size 6cm × 6cm to cover the floor When he went to the market, he found that tiles of only 4cm × 4cm were available. How many tiles will he have to buy?
4. How many $decimetre^2$ are equal to 1 $metre^2$?

4.4 *Measurement of Volume*

WHAT IS VOLUME?

Fill a small *katori* with peas and then with mustard seeds You will need less number of peas than mustard seeds to fill the *katori* Can you tell why? It is because a pea being bigger in size occupies more space. Therefore a smaller number of peas will fill the *katori*

Similarly a brick occupies more space than a matchbox Also a football occupies more space than a cricket ball. The space

occupied by an object is called its volume The volume of a brick is greater than that of a matchbox

If you fill a bucket and a glass tumbler with water, the bucket will hold more water. In other words, the capacity of a bucket to hold water is greater than that of a glass tumbler

The space available in a container is called its capacity. In fact, the capacity of a container is its inner volume

You say that a buffalo gives more milk than a cow What are you comparing here? It is the volume of milk given by the cow and the buffalo

The volume of a cuboid is

Volume = length × breadth × height

The volume of a metre cube is $1m \times 1m \times 1m = 1m^3$ It is read as metre cube

Thus a standard unit of volume is metre^3 or metre cube

When the object is small, instead of considering m^3 as a unit, you may consider cm^3 or dm^3 as a unit These are read as centimetre cube and decimetre cube, respectively

Activity 2

Find out the volumes of the objects given in Table 4 4 and record your measurements

VOLUME OF LIQUIDS

Liquids such as milk, kerosene and petrol are measured by their volume

Look at Fig 4 14. You must have seen these devices for measuring volume The measuring cylinder (a) is used in laboratories to measure any desired volume of liquids Note that there are markings on the transparent body of the cylinder It can therefore be used to measure any desired volume of a liquid A similar device (b) is used by doctors to measure liquid medicines Device (c) is used for measuring kerosene and petrol. It can be seen at petrol stations. Devices (d) and (e) are generally used for measuring milk or oil Devices (c), (d) and (e) can measure only a fixed volume

TABLE 4 4
Calculation of Volume

S No	*Objects*	*Length (l)*	*Breadth (b)*	*Height (h)*	*Volume = l×b×h*
1	Matchbox				
2	Brick				
3	Your classroom				
4	Science textbook				

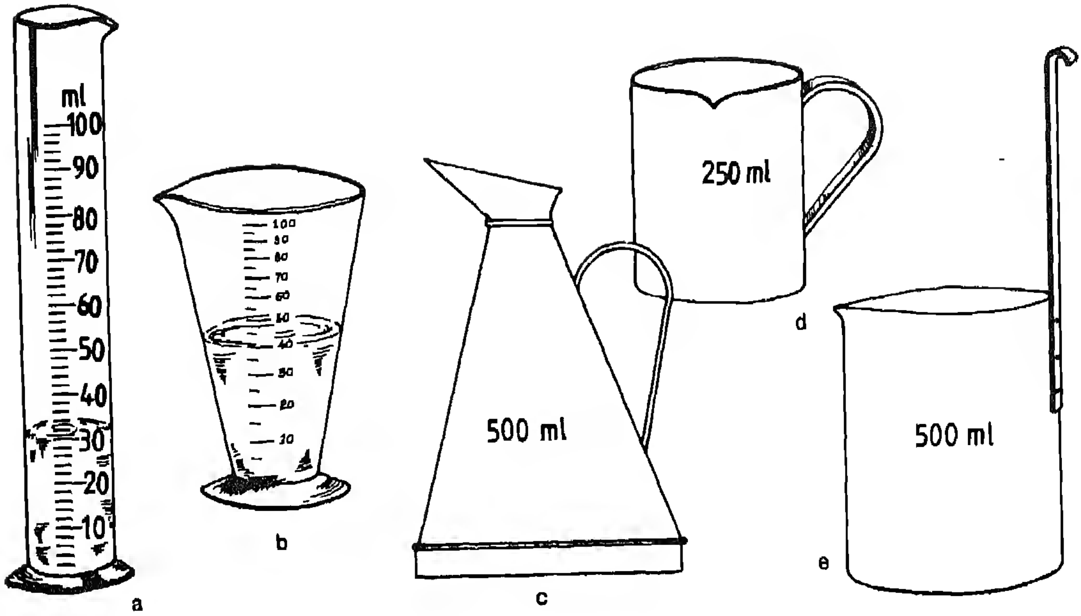


Fig. 4 14 *Various devices used to measure the volume of liquids*

of liquids The fixed quantity is determined by the capacity of the container. It is because there are no other markings on the body of these devices like those on a cylinder The volume of liquids is expressed in litre (l) or millilitre (ml)

$$1 \text{ litre} = 1000 \text{ cm}^3$$

$$1000 \text{ ml} = 1 \text{ litre or } 1 \text{ ml} = 1 \text{ cm}^3$$

The measuring cylinder has to be used carefully. The following steps should be taken while using the measuring cylinder:

Step 1

To find the volume of a liquid which is represented by one small division, observe the scale carefully. Consider two consecutive major markings. Find out the volume of the liquid represented between these markings. Now divide this volume by the total number of divisions between these two major markings It will give you the volume represented by one small division.

Observe the markings on cylinders A and B carefully (Fig.4 15). The volume represented by one division for A is 1 ml and for B is 2 ml. Thus, you cannot use cylinder A for measuring volume less than 1 ml. Similarly cylinder B

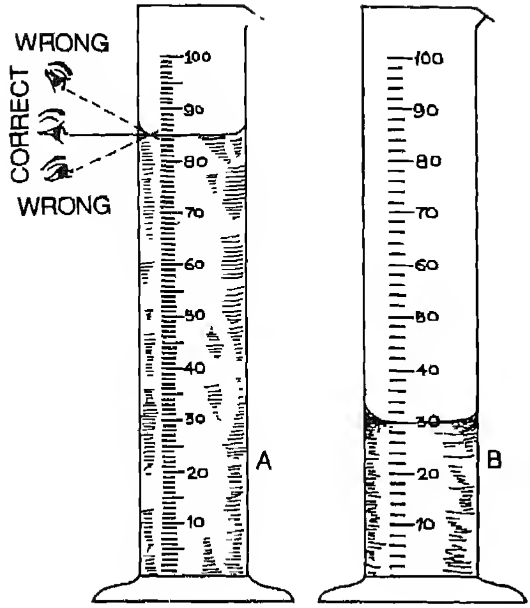


Fig. 4 15 *Position of the eye for the proper reading of the measuring-cylinder*

cannot be used for measuring volume less than 2 ml.

Step 2

The measuring cylinder should be kept on a horizontal even surface such as a book or a table.

Step 3

Note that the surface of the liquid is curved (Fig 4 15) The eye should be in level with the lowermost point of the curved surface of the liquid (Fig 4 15) Note that the volume of the liquid in cylinder A is 85 ml and not 80 5 ml In cylinder B the volume of the liquid is 30 ml and not 25 ml.

VOLUME OF IRREGULAR SOLIDS

The volume of irregular solids such as a piece of stone, stopper, etc., can be found by using a measuring cylinder. This method can be used only for those solids which can enter the measuring cylinder Other methods are used for objects of bigger size

Take a suitable measuring cylinder and fill it nearly half with water. Note down the reading Let it be x ml.

Tie a thread round the solid and lower solid gently into the water in the cylinder. Do you observe any change in the level of water in the cylinder? Record the raised level of water. Let it be y ml The volume of solid = $y - x = z$ ml.

In this way you can find the volume of an irregular solid which sinks in water and does not dissolve in it Can you suggest a method to find the volume of a solid which floats on water such as a cork?

ANSWER THESE

1 What is meant by the capacity of a container?
2. A small water-tight cubical box has sides 1 cm each. Sixty-four drops of water from a dropper can fill the box completely What is the volume of one drop of water?
3. Fill in the blanks
   (i) The volume of an object is the ________ occupied by it.

(ii) The volume of liquids is expressed in ____________

(iii) To read the volume of a liquid in a measuring cylinder it should be kept on a ________ surface

(iv) 1 cm^3 is equal to ________ ml.

4 Describe the method used to determine the volume of an irregular solid which is heavier than water and insoluble in it

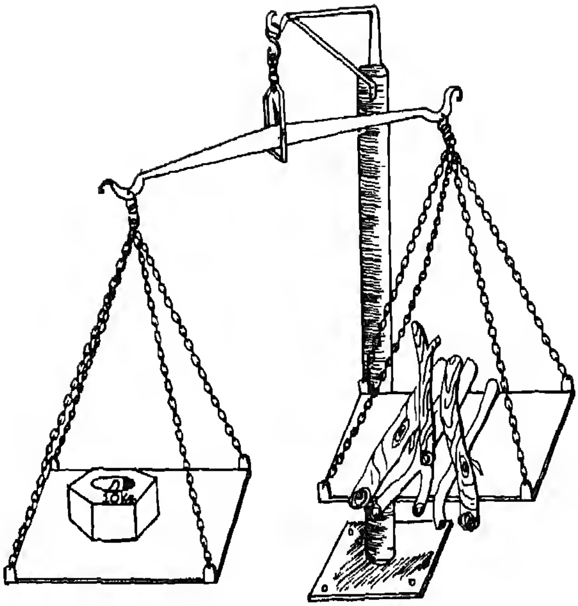
4.5 *Measurement of Mass*

WHAT IS MASS?

You must have experienced that two handfuls of sand feels heavier than one handful Two handfuls of sand feel heavier because the quantity of matter (sand) in it is more than that in one handful Similarly, a glass of water feels lighter than a bucket of water because the quantity of matter (water) in the glass is less than the quantity of matter (water) in the bucket The object which is heavier is said to have more mass because it has more matter in it. The mass is the measure of the quantity of matter.

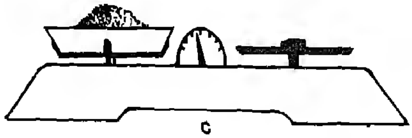
UNIT OF MASS

The mass of an object is measured with the help of a beam balance. Figure 4 16 (a) (b) (c) (d) shows a variety of beam balances which are used for measuring



a

b



c

Fig. 4.16 (a)(b)(c)

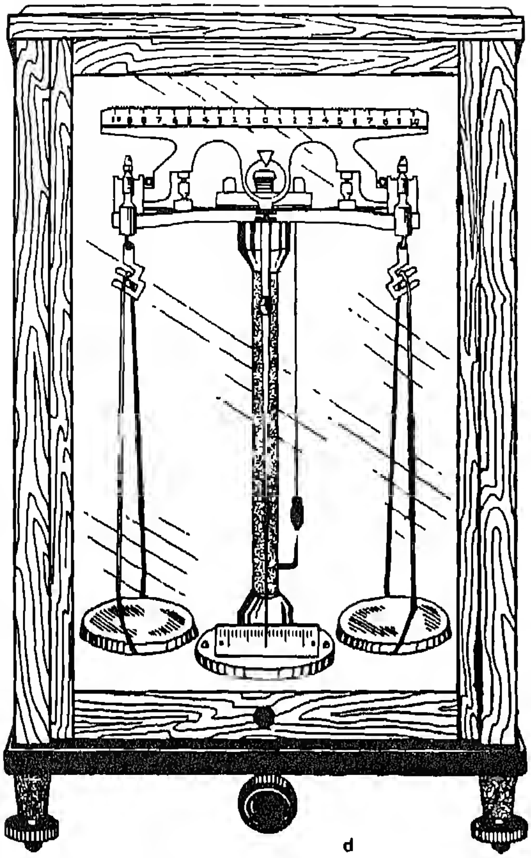


Fig 4. 16(d)

mass The standard unit of mass is kilogram. It is written as kg.

Many a time scientists and pharmacists have to use a very small mass of a substance Goldsmiths also measure a very small quantity of gold and silver. Also when you buy cloves or cardamom or cinnamon you buy only very small quantities of them Thus, there are many occasions when you have to find the mass of small quantities of substances For the sake of convenience small mass is expressed in the units of gram and milligram

1000 gram (g) = 1 kilogram (kg)
1000 milligram (mg) = 1g

When you buy large quantities of wood, coal or wheat, it is convenient to express the mass of these large quantities in larger units such as quintal or tonne

100 kg = 1 quintal
10 quintals = 1 tonne (1 metric ton)

MEASURING MASS

Activity 3

Take a beam balance or make one using empty shoe polish tin cans or coconut shells as shown in Fig 4 17 (a).

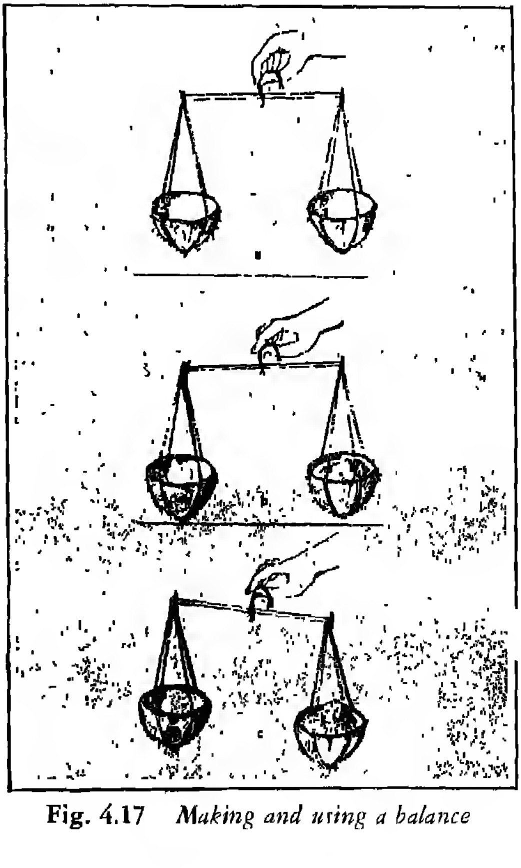


Fig. 4.17 *Making and using a balance*

Suppose you want to weigh 100 g of rice. To do that put the weight of 100 g in the left-hand pan and go on adding rice in the right-hand pan till the beam is horizontal If the rice is less [Fig 4.17 (b)] or more [Fig. 4 17 (c)] than 100 g the beam will not be horizontal

Suppose you want to find the mass of a given object, say a notebook. Keep the notebook in one pan and the standard weights in the other till the beam is nearly horizontal Find the mass of the notebook from the weights used Now remove the notebook and put your science textbook in that pan Go on adding weights till the beam is horizontal Find the mass of the textbook by recording the weights used. Which is heavier, the textbook or the notebook, and by how much?

Note that in order to weigh a certain fixed mass of a substance, you fix the weights and vary the quantity of the substance till both are equal If you want to find the mass of a given substance, you vary the weights till both are equal

NEED FOR ACCURATE MEASUREMENT OF MASS

You must have seen that neither the shopkeeper selling coal, wood or wheat nor the customer minds a small error in the measurement of the mass of these items But when costly items made of gold and silver are being weighed both the customer and the shopkeeper would like the measurement of the mass to be made as accurately as possible They would like to use a balance which can measure a small mass very accurately Besides the cost of the item, the purpose for which the measurement has to be made also determines the extent of accuracy to be achieved in the measurement. If a scientist has to use a small mass of coal or wood in his experiment, he would like to measure the mass of these substances more accurately in spite of the fact that they are cheap Scientists and goldsmiths use physical balances [Fig. 4.16(d)] which can measure a small mass very accurately.

BEWARE BEFORE YOU BUY

There are many things in the market which are sold by the mass When you go to market to buy things which are sold by the mass, you must ensure that the beam balance and weights used are correct Fig 4.18 (a) shows a correct

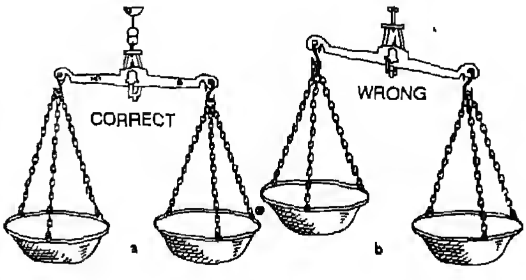


Fig. 4.18

beam balance. In this, the handle is so designed that it cannot manipulate the beam The beam should be able to move freely on the central axis This ensures accurate measurement The beam must

have stamps of the Weights and Measures Department on both sides of the central axis. In an incorrect balance [Fig. 4 18 (b)] the handle can be welded with the beam. It can manipulate the beam This results in under-weighing

You must also ensure that the weights used are correct The amount of weight is written on the upper side of the weight. The weight is made of metal. It has a hole at the bottom in which some lead is filled [Fig 4 19 (a)] There is a stamp of Weights and Measures

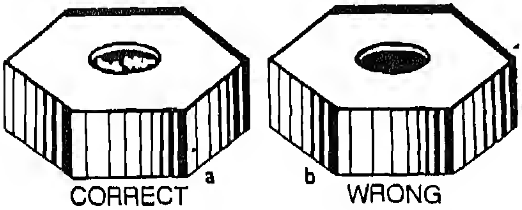


Fig. 4.19

Department in the centre of the lead An incorrect weight may not be of metal. Some metal weights may not have lead filling and they may not have the stamp of the Weights and Measures Department [Fig 4 19 (b)]. This also results in under-weighing

Go to the shops in your locality and find out whether the shopkeepers are using correct balances and weights.

ANSWER THESE

1 Calculate the mass of water in a tank of length 50 cm, breadth 40 cm and height 10 cm, if the mass of 1 cm^3 of water is 1g
2. What is mass? What is the standard unit of mass?
3. Under which two conditions has the mass of an object to be measured correctly?
4 How many quintals make one metric ton?
5 How will you ensure that a beam balance is correct?

4.6 *Measurement of Temperature*

Activity 4

Take three bowls. Put cold water in one, hot water in the other and lukewarm water in the third Dip your right-hand fingers in the cold water and left-hand fingers in the hot water (Fig 4.20) Keep them there for a minute Now take out the fingers and dip them quickly in the bowl of lukewarm water Does the water feel equally hot to both the hands? Thus, you have seen that you cannot rely

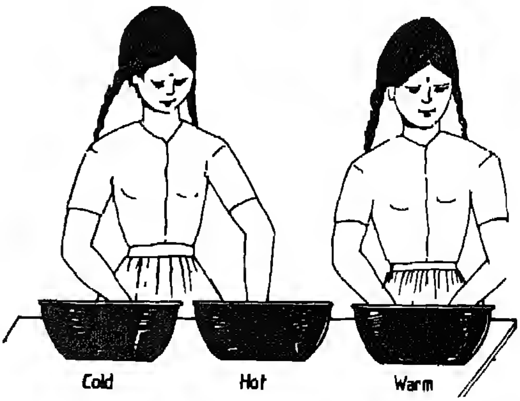


Fig. 4.20 *Our sense of touch may misir' us.*

on your sense of touch for estimation of temperature

Therefore, to measure temperature accurately, a special instrument is needed It is called thermometer. It measures the degree of hotness of a body The temperature is thus a measure of the degree of hotness of a body.

You must have seen the thermometer which is used at home or by a doctor for measuring body temperature. This thermometer is called clinical thermometer. Scientists also use various types of thermometers to measure temperature

TEMPERATURE SCALE

Temperature is measured in degree Celsius. It is written as °C. A thermometer has two standard markings. To get the standard markings on a thermometer two fixed points are required—one is called the lower fixed point and the other upper fixed point The lower fixed point is the temperature of melting ice. The upper fixed point is the temperature of steam of boiling water. If you want to measure the temperature of a candle flame, you cannot use this thermometer

You can see from Fig 4.21 that the clinical thermometer does not have the markings from 0°C to 100°C It cannot therefore be used to measure the temperature of ice or boiling water. It can measure only a short range of temperatures from about 35°C to 42°C. It is so graduated because the temperature of the human body does not

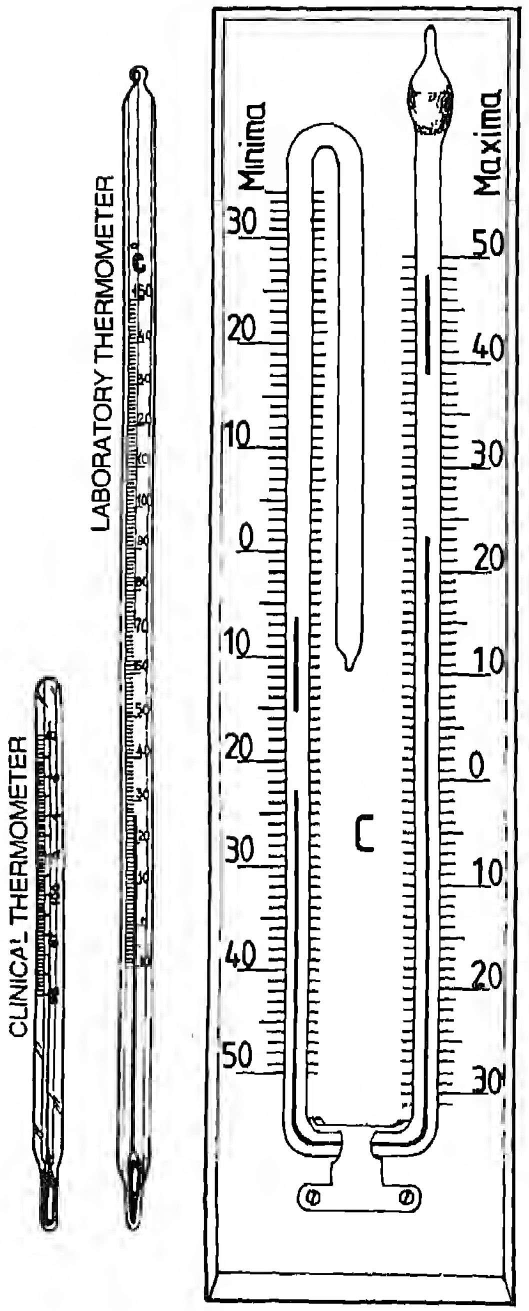


Fig. 4.21 *Various types of thermometers*

vary beyond these temperatures. The temperature of a normal human body is 37°C

In order to measure very high temperatures of objects like flames, ovens and furnaces many other types of thermometers have been designed (Fig 4 22)

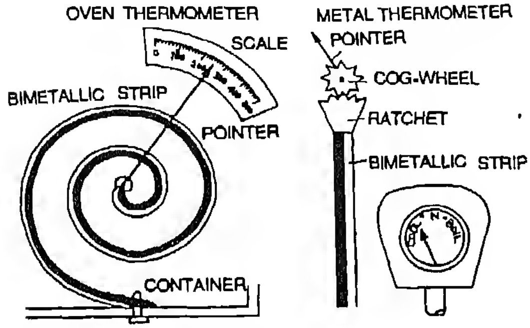


Fig. 4.22 *Thermometers for measuring high temperatures*

RECORDING TEMPERATURE

Take a thermometer. Look closely at its scale. Find the temperature represented by one small division Hold the thermometer so that you can see a very thin silvery line inside. The upper end of this line tells you the temperature

Activity 5

Take a laboratory thermometer. Take some hot water in a *katori* and dip the bulb of the thermometer in the water. Do you observe the shining thread moving upward? This thread is of mercury. A stage will come when the thread will stop rising. The temperature indicated by the thermometer at this stage is the temperature of the water in the *katori*. Whenever you measure the temperature with a thermometer, you must wait until the thread of mercury stops rising

Activity 6

Take a clinical thermometer and measure your body temperature. To do this, hold the thermometer firmly in your hand and jerk it two or three times so that the thread of mercury falls below 35°C Now put the bulb of the thermometer under your tongue Hold it there gently for about a minute Take it out and observe the tip of the thread of mercury Read the temperature marking against it on the thermometer.

ANSWER THESE

Fill in the blanks

1. The lower fixed temperature in Celsius thermometer is the melting point of ________
2. Temperature is the measure of ________of an object.
3. The thermometer used to measure human body temperature is called ________ thermometer.
4. The normal temperature of human body is ________ °C

4.7 *Measurement of Time*

You know at what time your school

starts. If you do not reach school on time, you may be marked absent When you travel by bus or train, you have to know the time when the bus or the train leaves If you do not reach the station on time, you may miss your bus or train. You also have to know the time when to switch on your radio or TV to listen to or watch your favourite programme Thus, knowledge of time is very important.

In olden days, people did not have watches or clocks. They used the various events which repeated regularly, to count time interval They used the time from sunrise to sunset or the next sunrise, the length of the shadow, one full moon to another full moon, the change of seasons, etc, to measure time interval. When the need of measuring small time intervals was felt, these events could not be used as the basis for the measurement of time interval

Later, the events which repeated regularly and at equal intervals of time, were found out Such events are said to be periodic For example, if you play on a swing the time it takes to swing from one side to another is always constant whether you play on it in the morning or afternoon, in winter or summer A process such as this is used to measure time interval. This principle of periodic motion is used in making wall clocks and watches (Fig 4 23) Nowadays most of the clocks or watches use the periodic motion of a wheel to measure time interval.

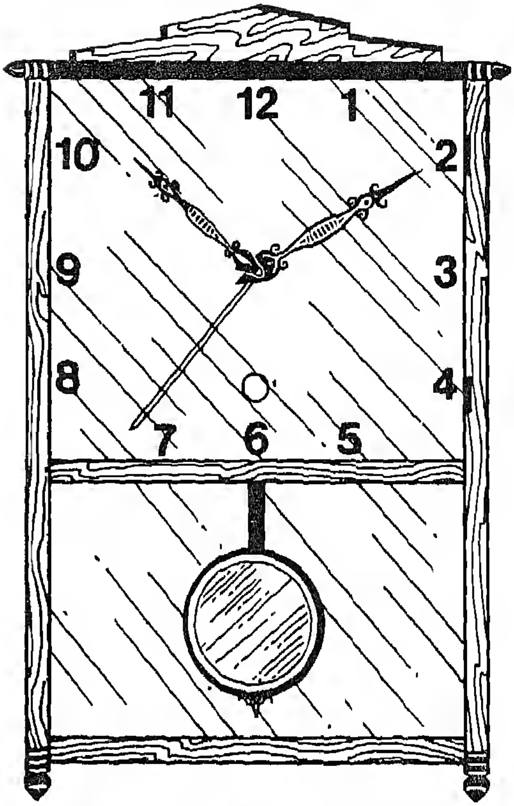


Fig. 4 23 *Wall clock using the periodic motion of the pendulum*

UNITS OF TIME

The standard unit of time all over the world is *second* Time for longer events is expressed in larger units. The larger units of time are minute, hour and day.

60 seconds (s) = 1 minute (min)
60 minutes (min) = 1 hour (h)
24 hours = 1 day

Month and year are also used as units of time to express still longer time interval For example to describe your age, you use years and months Suppose you are 11 years old You do not say that you are 4015 days old or 96360 hours old.

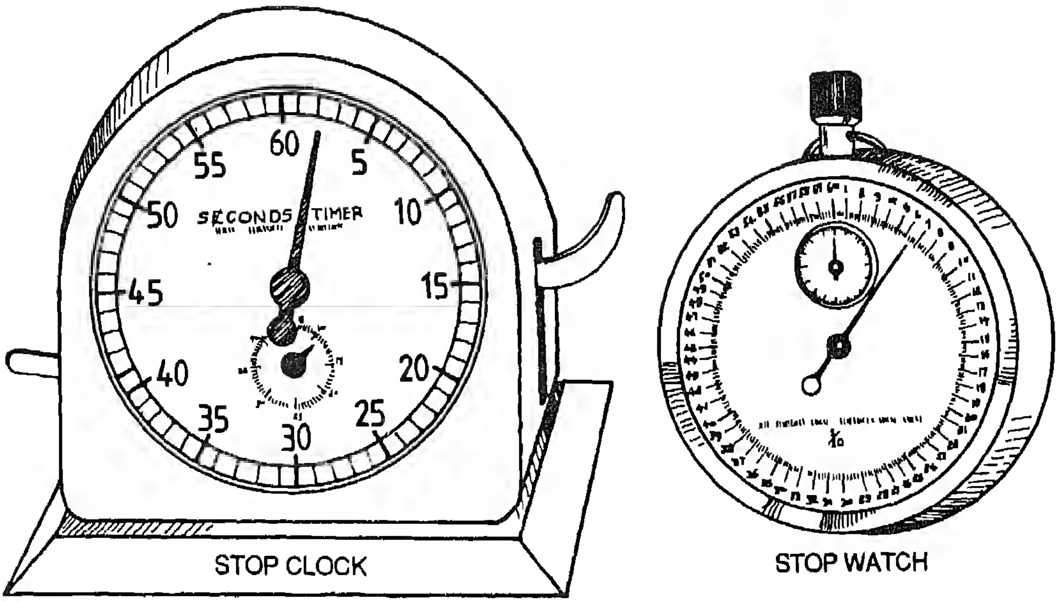


Fig. 4.24

MEASURING TIME

You want most of your watches or clocks to run continuously. Most of the watches cannot be stopped and started at your will Many a time you may want to know the time taken for an event, such as the time taken by an athlete to run 400 metres. To measure the time taken by such events accurately special watches are available These can be started and stopped at will. Such watches are called stop watches (Fig. 4 24)

Activity 7

Table 4 5 gives certain tasks which

TABLE 4 5

Time taken to Complete Certain Tasks

S.No.	*Tasks*	*Estimated time*	*Actual time*
1	To fill a bucket of water from tap		
2	Brushing the teeth		
3	Clapping your hands ten times		
4	Running two rounds of your school playground		
5	Reading each line of this page		

concern you. Estimate the time taken to complete each of these tasks and record it in front of each Also measure the time taken to complete them with the help of a watch or a clock and record in the table. Compare the estimated time with the actual time taken to complete the tasks If your estimates are wrong, you can improve upon them by practice

Activity 8

Take an empty tin can Cut the top face of the can Make a very small hole with a nail in the centre at the bottom of the can. Keep the can over two bricks Close the hole with a finger and fill the can up to the brim with water Remove the finger and note the time. When the water has drained off completely, record the time again. Find the time taken for the entire water to drain off Repeat this activity. Is the time taken this time the same as before? This is your water clock. Take another tin can of different size and find out the time the water takes to drain off Such clocks were used in olden days

ANSWER THESE

1 The standard unit of time is
(i) hour (ii) day (iii) second (iv) minute.

2 What are periodic events?

3. What kind of watch is used to measure the time of sports events?

YOU NOW KNOW

— Your senses cannot make correct measurement
— Measurement is a process of comparing with a standard unit
— Standard units of measurement are necessary for the purpose of uniformity
— Standard units of length, mass and time are metre, kilogram and second, respectively
— Measurement of width, height and depth involves the process of measuring length
— The choice of a length-measuring device depends upon the type of measurement to be made.
— Certain precautions have to be taken while using a metre scale
— Special techniques are used to measure small thickness
— Estimation of measurement is an important and useful skill
— The area of a rectangular object is found by multiplying its length and breadth
— The unit of area is metre^2 and is read as metre square
— Smaller areas are expressed in the units of cm^2 and mm^2 whereas larger areas are expressed in the units of 'are' and hectare
— The area of irregular objects can be found with the help of a graph paper.
— Volume is the space occupied by an object

- — The capacity of a container is the space available in it.
- — The volume of a rectangular solid is found by multiplying its length, breadth and height
- — Volume is expressed in the units of m^3, cm^3 or mm^3.
- — Volume of liquids is expressed in the units of litre or millilitre.
- — Measuring-cylinder is used for measuring the volume of liquids
- — The volume of irregular solids is found by using water and measuring-cylinder
- — The mass of an object is the quantity of matter in it
- — Mass is expressed in the units of kg, g or mg
- — Mass is measured with the help of a beam balance
- — Measurements have to be made accurately.
- — Temperature is the degree of hotness of an object
- — Temperature is expressed in the unit of °C.
- — Temperature is measured by using a thermometer.
- — The thermometer used for measuring human body temperature is called clinical thermometer.
- — Events which repeat regularly and at equal intervals of time are called periodic
- — Periodic events are used for measuring time interval.

NOW ANSWER THESE

1. Why is it necessary to have standard units of measurement?

2. Match the physical quantities given in Column I with their units given in Column II.

Column I	*Column II*
Time	metre^3
Length	metre^2
Temperature	metre
Volume	degree Celsius
Mass	second
	kilogram

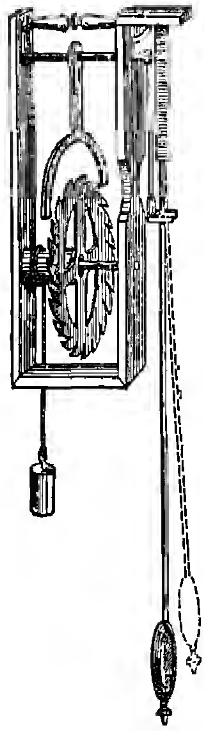
3. Describe the method of finding the area of an irregular object such as the palm of your hand.

4. State the precautions to be followed while finding out the volume of a liquid using a graduated cylinder

5. Match the physical quantities in Column I with their meanings in Column II

Column I	*Column II*
Mass	Distance between two points
Area	Space occupied
Volume	Degree of hotness
Temperature	Quantity of matter
	Measure of the surface of an object

6. Draw a diagram of the laboratory thermometer. Mark the lower and upper fixed temperatures on a Celsius scale.
7 Describe the method of making a water clock using a tin can



Changes Around Us

FROM MORNING TILL NIGHT you observe many changes around you You observe them at your home, school, playground, or any other place. For example, sudden change in weather, rainfall, flowering of plants, germination of seeds, ripening of fruits, drying of clothes, change of day and night, melting of ice, evaporation of water, burning of fuels, cooking of rice, making of *chapatis*, formation of curd from milk, rusting of iron, burning of fireworks, etc., are the changes around you. Changes may involve different kinds of alterations in the things around you Some of the changes which you see are alterations in position, shape, size, colour, state, temperature, composition and structure. A change always has some cause which brings it about You will learn more about changes in this unit

5.1 *Classification of Changes*

You have learnt how to classify things in Unit Two. Can you think of the ways you can classify the changes? Have you ever thought whether changes are of the same type or different from one another?

Obviously, you will say that all the changes are not of the same kind Some changes are slow and some are fast, some are desirable and some are undesirable, some are periodic and some are non-periodic, some are reversible and some are irreversible; some are physical and some are chemical (Fig 5 1)

Now you will study about various types of changes.

SLOW AND FAST CHANGES

You must have seen the burning of paper or a match stick You must have also seen the rusting of iron nails and the bicycle rim

Do you think the time required for these changes is the same or is it different?

They take different amounts of time to occur. The burning of match stick is much faster than the rusting of iron nails

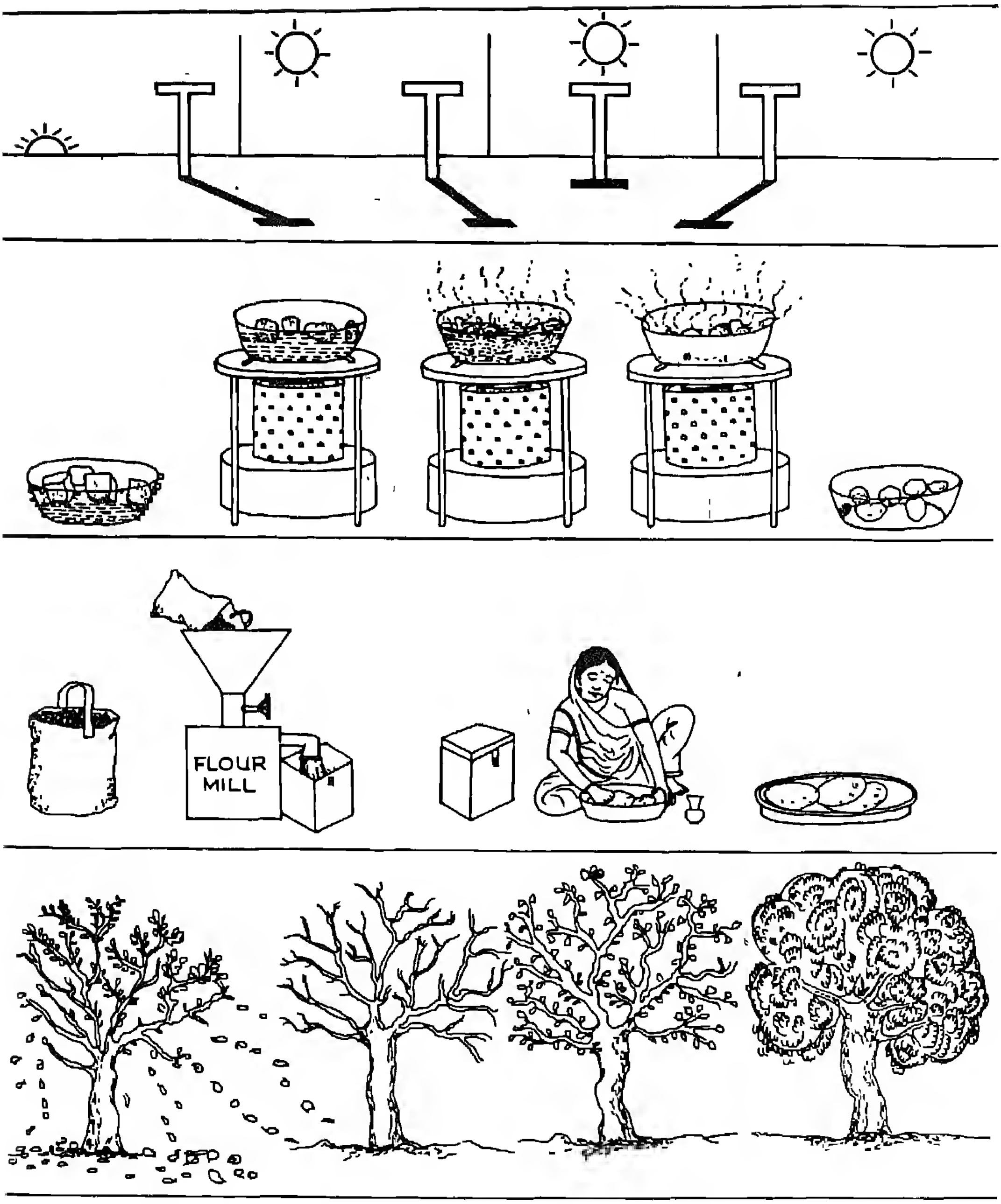


Fig. 5.1 *Various types of changes taking place in our day-to-day life*

Thus you see that some changes are very fast and some are very slow. Slow changes may take place over days, months, or years (Fig. 5.2) while fast changes may occur within a short time (Fig. 5.3)

Can you give some more examples of slow and fast changes?

Activity 1

Classify the following changes as slow or fast.

(i) Spinning of a top
(ii) Formation of day and night
(iii) Formation of curd from milk
(iv) Change of season
(v) Curdling of milk by adding lemon juice

DESIRABLE AND UNDESIRABLE CHANGES

You want some changes because they are desirable, for example, formation of curd

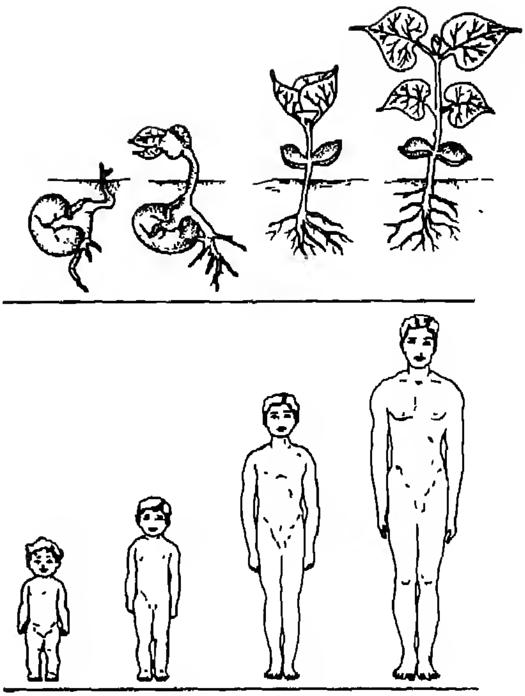


Fig. 5.2 *Slow changes*

Fig. 5.3 *Fast changes*

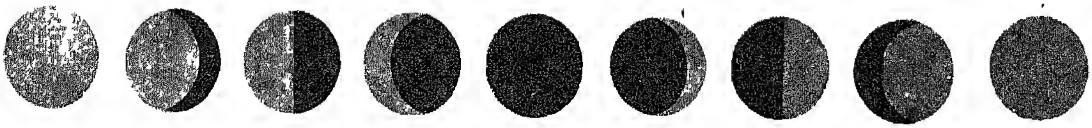


Fig. 5.4 *Phases of the moon—a periodic change*

from milk and formation of manure from cowdung and dead plants are desirable changes. But there are some changes which may be undesirable The breaking of a glass tumbler, the spoiling of foodstuff, the burning of a factory and the flooding of a river are examples of undesirable changes

You will realise that a change may be desirable at one time but undesirable at some other time For example, the burning of a fuel (wood, coal) to produce heat is a desirable change. However, burning is undesirable when it burns a house or a factory. Sometimes, undesirable changes may also occur with a desirable change For example, when coal burns in a thermal power plant, it produces electricity, which is desirable, but it also produces smoke and dust, which are undesirable

A change may be desirable for someone and undesirable for some others. The cutting of trees may be desirable for one who needs wood but undesirable for others because it disturbs the balance in nature We should try to minimize the occurrence of undesirable changes

PERIODIC AND NON-PERIODIC CHANGES

You know that winter, summer, autumn, spring and rainy season recur every year You see that the full moon and the new moon nights also recur every month. These changes are *periodic* as they occur again and again after a fixed interval of time

Some more examples of periodic changes are your heart-beat, the phases of the moon (Fig 5.4), high and low tides in the sea, positions of a moving swing or the pendulum of a clock (Fig 5.5) In all these examples, you can

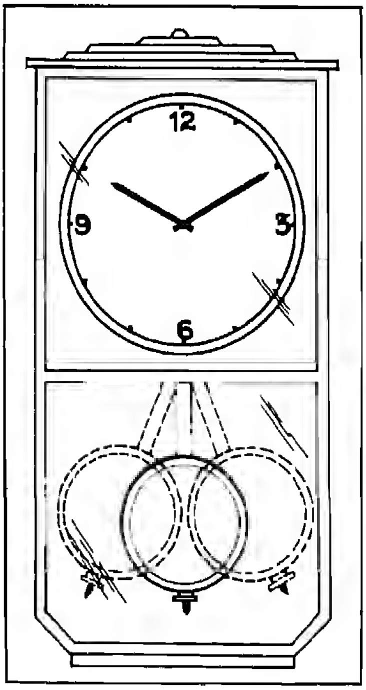


Fig. 5.5 *Swinging of a pendulum*

predict when the changes will occur again.

There are some changes which do not repeat themselves at regular intervals of time and about them you cannot predict when they will recur For example, the occurrences of earthquakes, landslides, train accidents and sneezing cannot be predicted since they do not occur after regular intervals of time

Such changes are called *non-periodic* changes Some more examples of non-periodic changes are the rusting of iron and the falling of tree leaves Can you think of some more examples of periodic and non-periodic changes?

You know that periodic changes repeat after regular intervals of time Therefore, such changes may be used to measure time intervals

REVERSIBLE AND IRREVERSIBLE CHANGES

You have learnt that ice changes into water on heating whereas on cooling water changes back to ice. Similarly, when you put a weight on a rubber band or a spring, it stretches but when you remove the weight, it comes back to its original shape (Fig 5 6)

If a change can be reversed, it is called a *reversible* change There are some changes which cannot be reversed Such changes are called *irreversible* changes For example, when a piece of paper is burnt, it changes into ash and

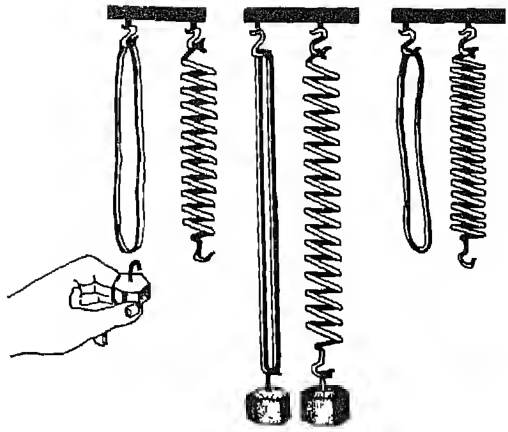


Fig. 5 6 *Reversible changes*

smoke. Can you get back the paper from ash and smoke? Obviously, not Ageing is another example of an irreversible change Have you ever seen an old man becoming young again? Some other irreversible changes are death and decay of animals and plants, the weathering of rocks, the falling of leaves from a tree and the changing of milk into curd.

Can you think of more examples of reversible and irreversible changes?

PHYSICAL AND CHEMICAL CHANGES

Break a wooden stick Cut or tear a piece of paper. Break a piece of chalk Stretch a rubber band. What do you observe? What happens when a glass tumbler breaks? It breaks into pieces Each piece of the tumbler is still glass. In all these cases, the size or shape of the objects has changed but the substances of which they

are made, remain the same In these changes no new substance is formed. Such changes are called *physical changes.*

Can you give some more examples of physical changes?

Activity 2

Take some water in a *katori*. Dissolve a teaspoonful of common salt in it The common salt disappears and forms a solution Now heat the solution till the water evaporates Taste the white powder left behind in the *katori*. This is the common salt you dissolved. Thus you find that no new substance has formed during this change. This is an example of a *physical* change. Conversion of ice into water and water into its vapours are also physical changes When you switch on, the filament of the bulb glows and produces light. When the switch is put off, the bulb stops glowing. Is any new substance formed inside the bulb? Certainly, not It is an example of a physical change.

Burn a small piece of paper. What does it look like now? When paper burns, carbon dioxide, water vapours and ash are produced None of these has the property of paper. Such types of changes are called *chemical* changes. When a substance undergoes a chemical change, new substances are formed (Fig. 5.7). A change in which new substances are formed, is called a chemical change.

Other examples of a chemical change are · formation of water from hydrogen

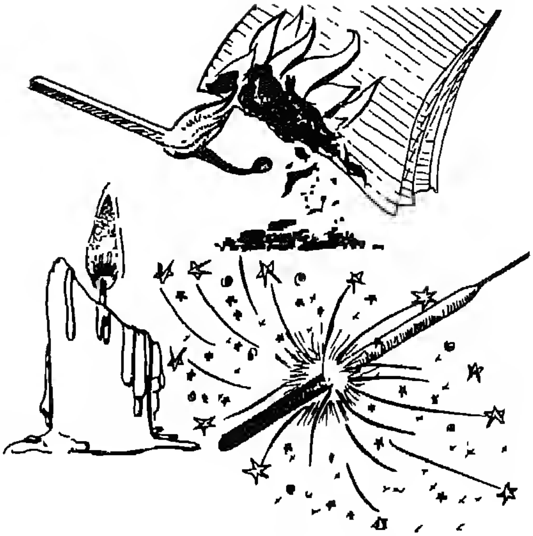


Fig. 5.7 *Chemical changes*

and oxygen, formation of curd from milk, cooking of food, rusting of iron and mixing of vinegar with baking-soda (which produces carbon dioxide). During all these changes new substances are formed.

The same substance may undergo a physical as well as a chemical change depending upon the conditions

The tearing of a sheet of paper into different pieces is a physical change, whereas its burning is a chemical change.

The change of ice into water and of water into water vapours is a physical change. The formation of hydrogen and oxygen from water by passing electric current is a chemical change

You have classified changes in various types depending upon the nature of the changes Sometimes the same change may be classified in more than one type. For example, formation

of curd is a desirable, chemical, slow and irreversible change. Can you give some more examples of changes that can be classified in more than one type of change?

You can control (speed up, slow down or prevent) some of the changes. For example, you can prevent or slow down the rusting of iron. You can slow down or prevent the spoiling of food. Do you know how?

On the other hand, there are changes over which you have no control. For example, you have no control over the change of day and night, the phases of the moon, the movement of the planets, the change of seasons, earthquakes, tides in the sea and the ageing of an animal.

You may also classify the changes as natural or man-made. List at least ten changes and classify them as natural or man-made.

ANSWER THESE

1. Give two examples each of:
   (i) Slow and fast changes
   (ii) Reversible and irreversible changes
   (iii) Periodic and non-periodic changes
   (iv) Desirable and undesirable changes
   (v) Physical and chemical changes.
2. Formation of liquid wax from solid wax on heating is a ________ change.
3. Formation of rust on a bicycle rim is a ________ change.

5.2 *Changes Involve Interaction*

You will notice that in the changes which occur around you, two or more materials influence each other. It means that they interact (act on each other) and may change some properties of each other. For example, when you are sharpening a pencil with a blade, both the blade and the pencil undergo changes. The change in the pencil can be seen immediately but the change in the blade can be seen only after repeated use when it becomes blunt.

Similarly, you might have also seen your father changing his shaving-blade after three or four days. Have you ever thought why he does so? In the process of shaving there is an interaction between the blade and the hair on the face. The blade cuts the hair and makes the face smooth. The hair, on the other hand, makes the blade blunt. Thus both the materials are affected due to interaction.

Look for a change on the face after shaving. Therefore, you could look for a change in those materials which undergo a larger change.

When a match stick is struck on the side of a matchbox, it catches fire. You see a scratch on the side of the matchbox where the match stick was struck. The interaction is more easily seen in the match stick than on the matchbox.

Activity 3

Take two tumblers Fill them about half with water. Add one teaspoonful of sugar in each tumbler Stir the water in one tumbler with a spoon Keep the other tumbler undisturbed. Observe carefully In which tumbler does sugar dissolve rapidly? (Fig 5 8)

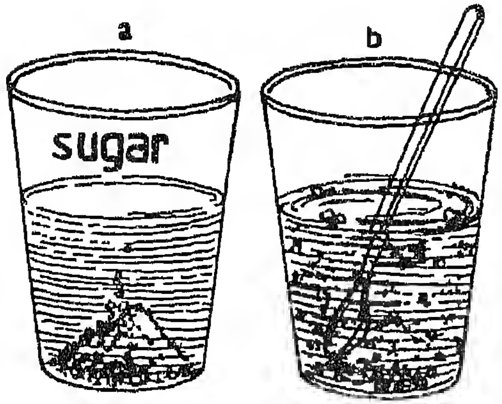


Fig. 5.8 *Dissolving sugar in water*
(a) Sugar kept unstirred
(b) Sugar stirred with a spoon

You will see that sugar dissolves rapidly in the glass tumbler in which the stirring was done It means that the nature of change depends upon the kind and extent of interaction

Some changes take place even when the two materials are not in contact For example, a magnet attracts iron objects even from a distance This leads to a change in the position of the iron objects

You have learnt that when a change takes place, there may be a change in the shape, size, colour, state, or position of the materials The interacting materials themselves may undergo a change

ANSWER THESE

1 Changes involve ____________ between materials
2 In a burning candle interaction takes place between ______ and _____
3 List four examples of changes in which you have observed interaction

5.3 *Changes Involve Energy*

When you whitewash your house, you dissolve quicklime in water What do you see? Bubbles and gases evolve and the container becomes hot What kind of change is this? In this change a lot of heat energy is produced, which makes the container hot

Activity 4

Fill a test-tube half with water Touch it Dissolve in it a teaspoonful of ammonium chloride *(naushadar)* or urea. Touch the test-tube again What do you feel? You will feel that the test-tube has become cooler In this change heat energy is absorbed

A container becomes cool when ice melts in it If you put a small amount of glucose on your tongue, it dissolves and your tongue feels cool Similarly, if you put a few drops of alcohol on the back of your palm, alcohol disappears and the back of your palm feels cool This is so because the heat energy required for these changes is taken from the surroundings, that is, from your body. If you carefully examine the changes

taking place around you, you will find that energy is either evolved (released) or absorbed during each change.

In some changes it is very easy to show the involvement of energy For example, for lifting a book or a bucket of water to change their positions, energy is provided by the body. Similarly, in the burning of a match stick, the energy evolved is due to a chemical change. But in many cases, it may be difficult to associate the changes with energy. For example, it may not be an easy exercise to show that energy is involved with the change of seasons, flowering of plants, ripening of fruits or drying of clothes It does not mean that there is no involvement of energy in these changes. You have seen that all changes involve energy in one form or the other In a change, energy is either absorbed or evolved In fact, a change cannot take place without the involvement of energy.

ANSWER THESE

1. Give two examples of changes in which energy is given out.
2. Give two examples of changes in which energy is absorbed
3. Energy is ____________ in the formation of curd from milk.

YOU NOW KNOW

— Changes around you are classified as slow or fast, periodic or non-periodic, desirable or undesirable, reversible or irreversible, physical or chemical, natural or man-made

— There is always a cause for a change.

— Some changes can be controlled

— Physical change is a change in which no new substances are formed Changes in state, shape, and size are physical changes

— In a chemical change, new substances are produced

— Every change involves interaction During interaction, the interacting materials may be in contact with each other or they may be at a distance

— During a change energy is either supplied (absorbed) or released (evolved)

— Every change involves energy in one form or the other.

NOW ANSWER THESE

1. State five changes observed by you.
2. Classify the following as fast or slow changes
   (i) Growth of a tree
   (ii) Change in seasons
   (iii) Burning of paper
   (iv) Making ice-cream
   (v) Beating of heart
   (vi) Weathering of rocks
   (vii) Breaking of a brick with a hammer

(viii) Ripening of fruits
(ix) Changing of the visible shape of the moon.

3. Mention three undesirable changes, giving reasons
4. State two changes which may be desirable as well as undesirable. Also give reasons.
5. Give two examples of periodic and two examples of non-periodic changes.
6. Classify the following as reversible or irreversible changes:
   (i) Growth of a plant
   (ii) Ploughing a field
   (iii) Melting of wax
   (iv) Falling of rain
   (v) Pulling of rubber string
   (vi) Breaking of a glass rod
   (vii) Cooking of food
7. Give two examples of a physical change and two examples of a chemical change.
8. Classify the following as physical or chemical changes:
   (i) Melting of glass
   (ii) Burning of *agarbatti*
   (iii) Tearing of cloth
   (iv) Formation of seed from flower
   (v) Cooking of food
   (vi) Formation of cloud
9. Fill in the blanks:
   (i) Formation of day and night is a __________ change.
   (ii) Bursting of a cracker is a __________ change.
   (iii) For making soda water, carbon dioxide gas is dissolved in water. This is an example of a __________ change.
   (iv) The glowing of a tube-light is a __________ change.
   (v) Rotation of a fan is a __________ change
   (vi) Changes in which a new substance is formed are called ____________________.
10. Give two examples of a change involving interaction between two materials.
11. Give one example of a change in which heat is given out.
12. Give an example of a change in which heat is absorbed.
13. State whether the following statements are true or false. Also correct the false statements.
   (i) The cooking of rice is a physical change
   (ii) Preparation of food by plants by using carbon dioxide is an undesirable change.
   (iii) When a glass tumbler breaks into pieces, the arrangement of molecules in glass changes.
   (iv) When you cut a fruit with knife, interaction between the fruit and the knife takes place.
   (v) When catechu *(kaththa)* is applied on lime while making a *pan,* a chemical change takes place.
   (vi) Eruption of a volcano is a periodic change.

Motion, Force and Machines

6.1 *What is Motion?*

LOOK AT FIG 6 1 and list the objects in it that were moving when this photograph was taken

The swing *(jhula)*, the ball, the bullock-cart, the blades of the windmill and the saw may be some of the objects in your list

In many cases, it is not difficult to notice the movement of objects But in some cases, it becomes difficult. The second-hand of a watch can be seen moving The minute-hand and the hour-hand do not move quickly like the second-hand. It is, therefore, difficult to say whether they are moving or not

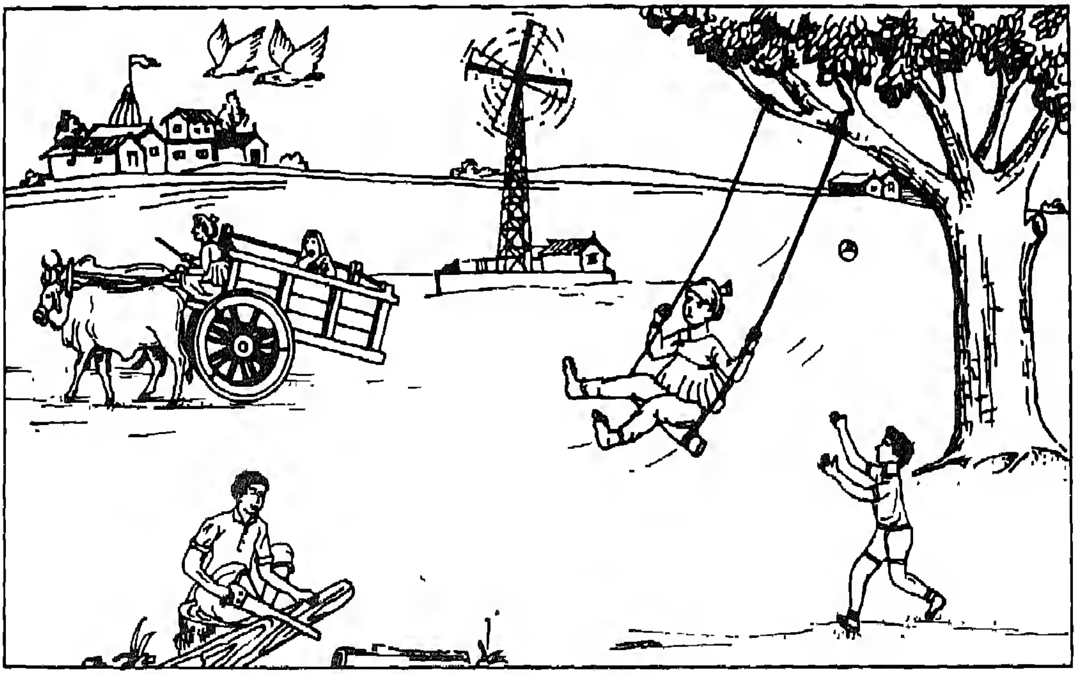


Fig. 6 1 *Some moving and stationary objects*

A clock is fixed high on a tower (Fig 6 2). It does not have second-hand Just by looking at it can you say whether it is working or not You will understand this by an example

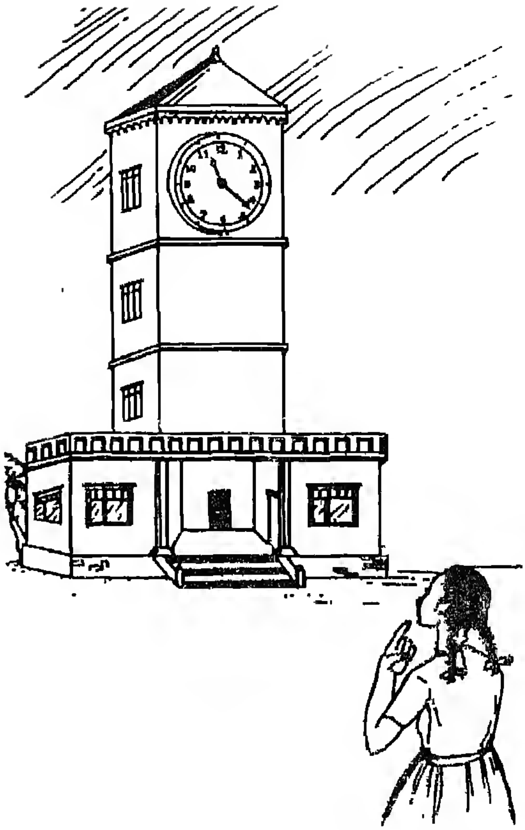


Fig. 6.2 *A girl looking at the clock*

Look at Fig 6.3. Initially the cow was near the hut Ten minutes later the cow was away from the hut. So you can say that the cow has moved. You can use a similar method to decide whether the clock on the tower is working or not

When an object changes its position with time as compared with a stationary object, it is said to be in motion.

ARE ALL MOTIONS ALIKE?

Usually you use certain words to represent certain movements. For example, when a tortoise moves forward, you say, 'it crawls'. When a liquid moves forward, you say, 'it flows'. Similarly, words like flapping of wings, waving of hands, etc , are used for certain movements. In science movements

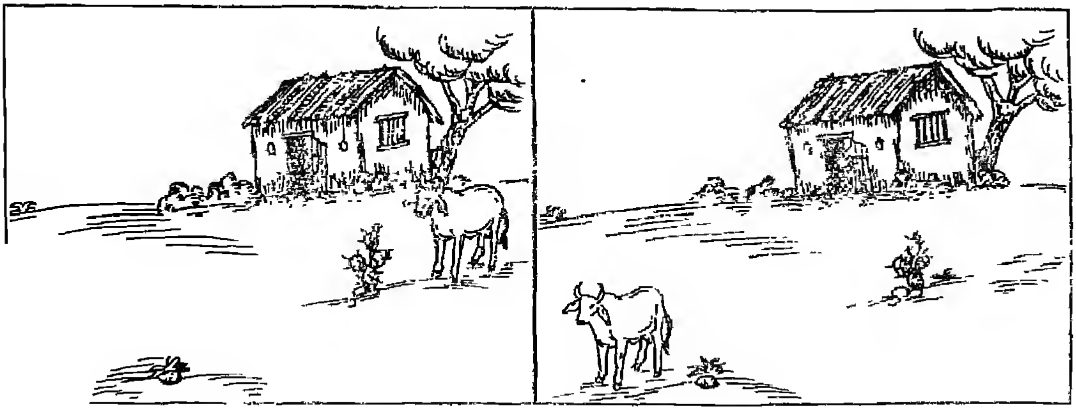


Fig. 6.3 *Change in the position of an object with time*

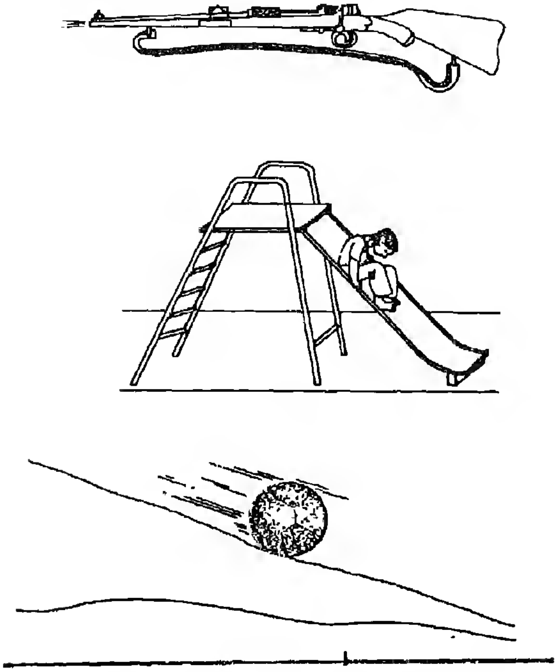


Fig. 6.4 *Some examples of the linear motion*

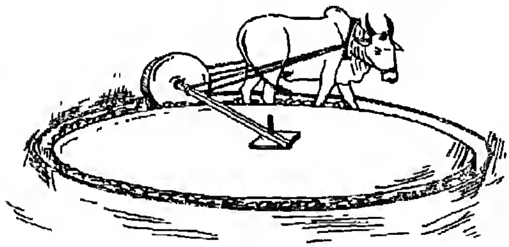


Fig. 6.5 *A bull moving around a central pole*

(motions) are classified as follows:

A bullet fired from a rifle, a boy sliding down a slope or a ball rolling on ground (Fig. 6.4) move along a line. All such motions are called *linear motions*. In a linear motion an object may move along a straight line or along a curved line.

The motions of a fly, of a player on a football ground, or of a child at home are not along a fixed path They keep on changing directions. Such motions are called *random motions*.

The moon moves round the earth The earth moves round the sun A bull shown in Fig 6.5 is moving around a central pole These objects move along a circular path. Such motions are called *circular motions*.

If a hanging object is taken to one side and then released, it starts moving like a swing (Fig. 6.6). Such a to-and-fro motion is called *oscillatory motion*.

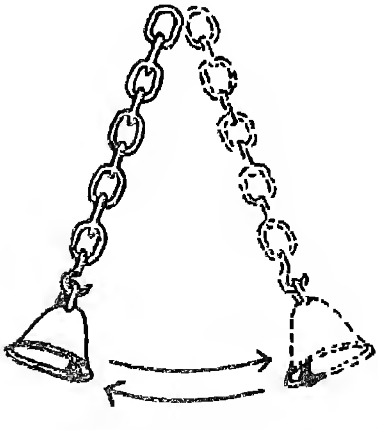


Fig. 6.6 *A hanging object performs oscillatory motion*

Activity 1

Fix a rubber string or a piece of an ordinary thread stretched between two nails (Fig 6.7) Pluck it just like the string of a *sitar* (or a violin) Observe its motion. What type of motion is this?

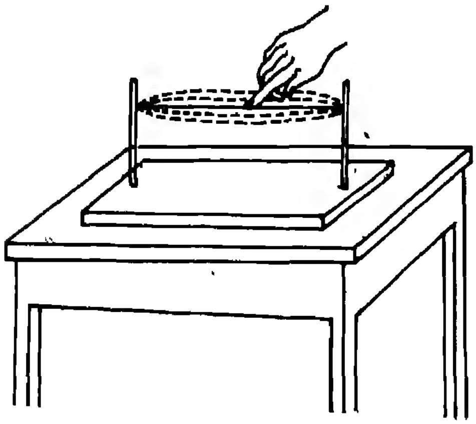


Fig. 6.7 *Vibration of a stretched string*

Take an empty metal vessel from your kitchen. Strike the vessel on its side by a rod or a spoon Immediately after striking, gently touch the vessel with your finger. What do you feel? The vessel has oscillatory motion

Place a few tiny pieces of paper (or sand grains) on a *dholak* or a drum (Fig 6.8) Strike the drum gently See what happens to the pieces of paper Why do they dance?

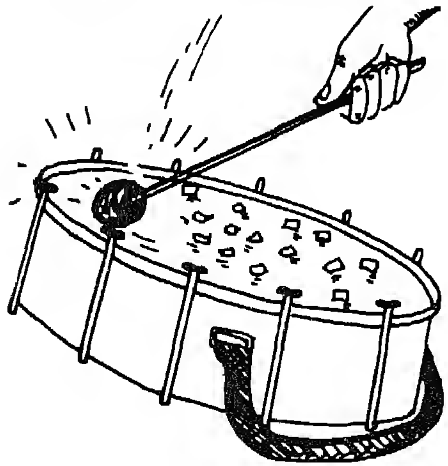


Fig. 6.8 *Pieces of paper dancing on the drum*

When an athlete runs on a circular track, for some time she may run fast and then she slows down It means the time taken for one round is not the same It is not so in the case of the hand of a clock It takes the same time to complete each round Such motions which repeat after regular interval of time are called *periodic motions* The motion of a swing is periodic

SPEED

You can reach a far-away place earlier on a bicycle rather than going on foot. A scooter or a bus moves faster than a bicycle Sometimes we find it difficult to decide which of the two moving objects is moving faster For example, one train travelled 120 km in three hours, another train travelled 180 km in four hours Which train moved faster?

To answer this question you may proceed thus: In three hours, the first train travelled 120 km It means that in one hour it moved 120/3 = 40 km. Similarly, the second train travelled 180/4 = 45 km in one hour Surely it has travelled faster than the first train Here you have calculated the distance travelled in one hour. It is called speed. You must

have heard someone saying, "the speed of the car is sixty kilometres per hour". It is usually written as 60 km/hour.

The speed can be calculated by using the relation

$$\text{Speed} = \frac{\text{Total distance travelled}}{\text{Time taken}}$$

You know that the standard unit of distance is metre and the standard unit of time is second. Therefore, the unit of speed is metre/second or m/s or ms^{-1}

For convenience the speeds of some objects are expressed in metres/minute (read it as 'metres per minute'). Cheetah is a fast animal. It can move with a speed of 1,700 metres/minute Swift is a fast bird. Its speed can go up to 6,000 metres per minute.

Next time you travel to a distant place, try to calculate the speed of the vehicle.

6.2 *What is Force?*

List the objects you moved today. Books,

Fig. 6.9 *Who is pushing and who is pulling?*

the school bag, clothes may be some of the items in your list. Every day you pick some objects and throw some away. Words like opening, shutting, kicking, hitting, lifting are used for certain kinds of tasks. In each of these tasks you move something. Look at Figs. 6.9 and 6.10 and decide who is trying to move what and how.

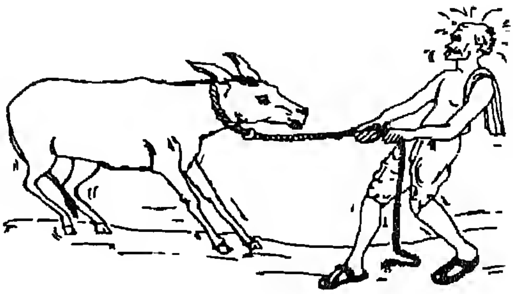


Fig. 6.10 *Who is trying to move whom?*

You can throw, kick, or hit a ball. In all these cases, you push the ball. Similarly, when you draw a bucket of water from a well, you pull the rope. Thus to move an object, it has to be either pulled or pushed. When leaves and pieces of paper fly away with the wind what is pulling or pushing do roofs of some huts fly storm? The wind push When you fly a kite, yo of the wind on it.

The push or pull force. The direction i pushed or pulled is ca

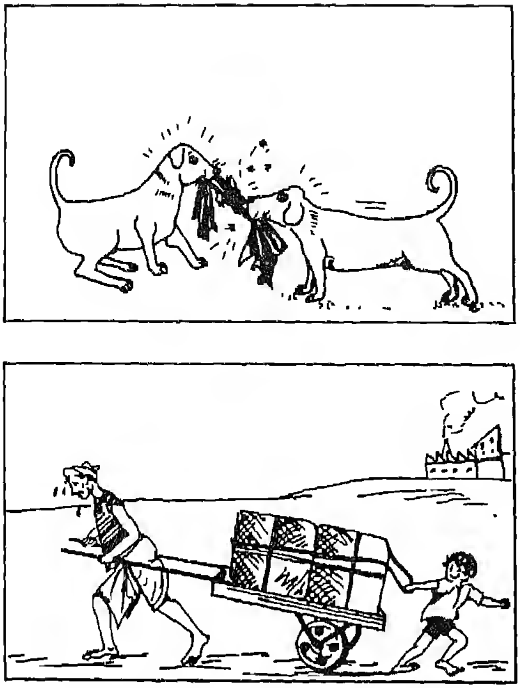


Fig 6.11 *Some objects being pulled or pushed*

the force Look at Fig 6 11, and say who is trying to push or pull

EFFECTS OF FORCE

Change in Speed

You find it difficult to run fast against the wind with an open umbrella When a man is pulling a cart, if someone pushes it from behind, will the cart move faster or slower? What will happen if, instead of pushing, it is pulled back? You will find that in both the cases the speed changes Thus, a force can change the ·ed of a moving object.

ity 2

a glass marble gently on the floor. Observe its speed While the marble is moving, hit it with another marble from behind. Observe the change in the speed of the first marble Now roll the marble again. Hit it by another marble from the opposite direction Observe the change in the speed of the first marble. All these observations show that if the force is applied in the direction of motion of the object, its speed increases and if the force is applied in the direction opposite to the direction of motion, its speed decreases

Change in Direction

Activity 3

Take a small piece of cardboard. Hold it in between two fingers Release it gently so that it falls down Note the path along which the cardboard falls Hold the cardboard again in between the fingers. Release it again so that it falls down. While it is falling, strike it with a finger of the other hand (Fig 6 12) Does it fall along the same path as before? Why did the direction change? While the cardboard was in motion, the push (force) given by your finger changed its direction

It is common experience that the smoke rising from an *agarbatti* changes its direction if you gently blow air on it. The blow exerts force During the game of cricket, if a moving ball is touched by a bat, the direction of the ball changes. Thus, it can be concluded that force can

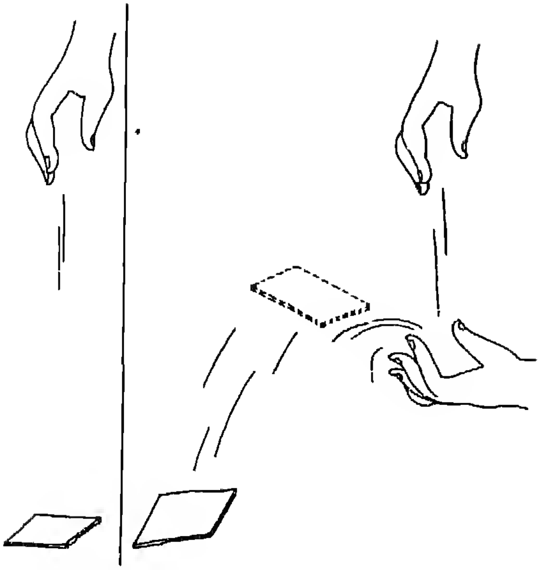


Fig. 6.12 *Force can change the direction of motion*

change the direction of motion of a moving object

Change in Shape

When a force is applied on an object, it may undergo a change in shape Some examples of change in shapes on applying force are given below.

The shape of dough changes on applying force (Fig. 6 13)

The shape of the sponge changes on pressing (Fig 6 14)

The shape of spring changes on pulling. (Fig. 6 15)

The shape of a toothpaste tube changes on squeezing (Fig 6 16)

The shape of iron strip changes on hammering (Fig. 6 17)

The shape of a tomato changes on pressing (Fig 6.18)

Force can thus change the shape of an object.

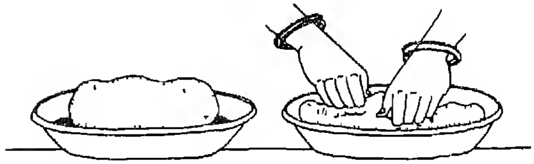


Fig. 6 13 *Shape of dough changes on applying force*

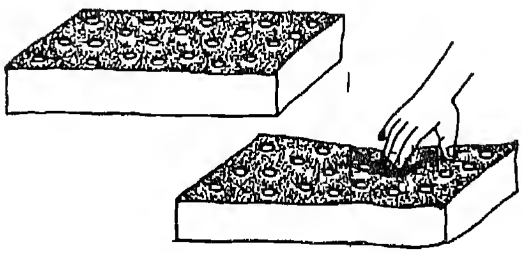


Fig 6 14 *Shape of sponge changes on pressing*

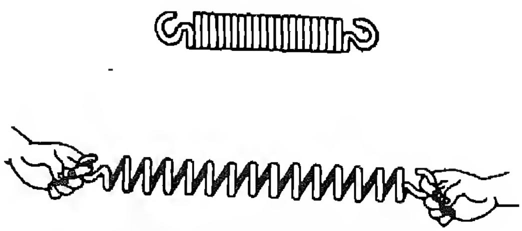


Fig. 6.15 *Shape of spring changes on pulling*

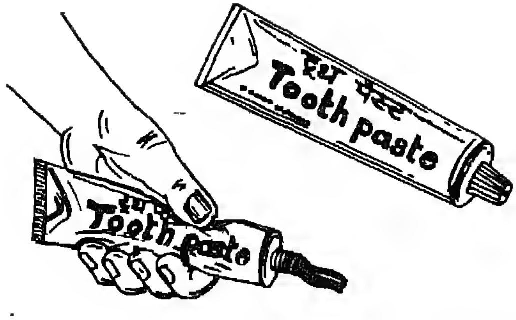


Fig. 6.16 *Shape of tooth-paste tube changes on squeezing*

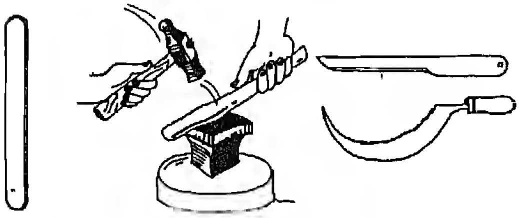


Fig. 6.17 *Shape of iron strip changes on hammering*

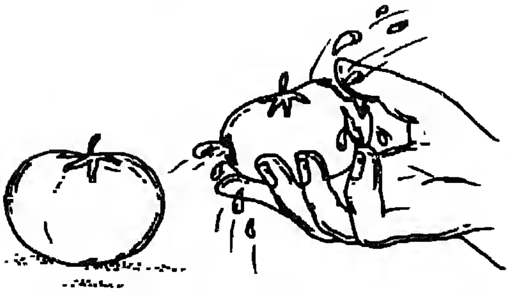


Fig. 6.18 *Shape of tomato changes on pressing*

TYPES OF FORCES

Muscular Force

To lift a stone some force is required. When you lift it by hand, the force is exerted by the muscles of your arm. The force exerted by the muscles is called muscular force. Both animals and human beings exert muscular force to do work (Fig 6.19)

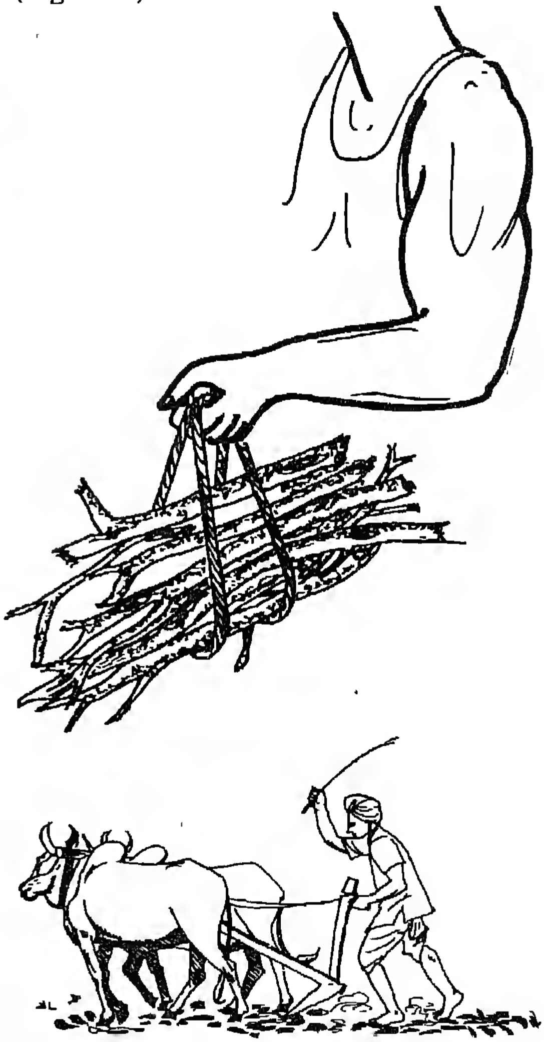


Fig. 6.19 *The muscles of animals and humans exert force*

Magnetic Force

If you bring a magnet near small iron objects like nails or pins, the magnet pulls them towards it. It means that the magnet has applied force on these

objects. The force exerted by a magnet is called magnetic force. Many toys work due to magnetic force exerted by magnets fixed inside them.

Electrostatic Force

Activity 4

Take a piece of paper and make very tiny pieces of it Place them over a notebook. Now take a comb or a plastic ball-point pen. Rub the body of the comb or the ball-point pen into your dry hair for about a minute Bring the rubbed comb or pen near the tiny pieces of paper Do you observe the pieces of paper moving towards the comb or the pen. (Fig 6 20)

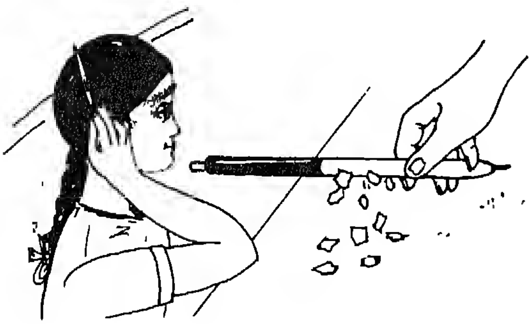


Fig. 6 20 *Pieces of paper being attracted by a ball-point pen when rubbed*

Activity 5

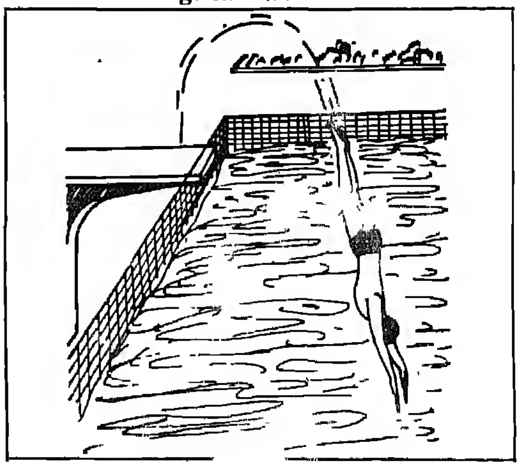
Take a feather Rub it between the pages of a book by pulling it out of the book pressing it slightly Rub it four or five times. Now hold the rubbed feather in one hand and bring one of your fingers near it. Observe the movement in the fibres of the feather.

The movement of the pieces of paper and of the fibres of the feather was due to the force exerted by the electrostatic charge acquired by the feather and the comb or the pen on rubbing. The force exerted by electrostatic charge is called electrostatic force

Gravitational Force

If a ball or a stone is released from some height, it falls down Do you know why? The earth pulls them down This pull of the earth is a force called the force of gravity The earth exerts this force on all objects. As the earth exerts force on bodies, so all other bodies exert force on each other The force exerted by bodies possessing mass is called gravitational force. When a diver dives into a swimming-pool, or a child falls from a tree, it is the force of gravity which brings down both of them—the diver and the child [Fig. 6.21 (a) and (b)].

Fig. 6.21 (a)



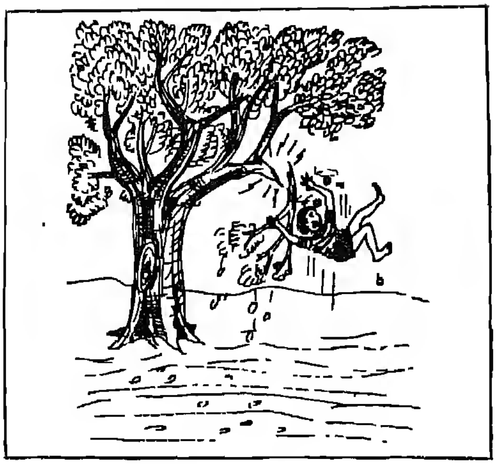


Fig. 6.21 (b)

What is Weight? Take a light spring or a piece of rubber string. Fix one end of this to a nail and note its length. Tie a small stone A to the other end of the spring or string. Observe the change in its length Replace stone A by a bigger stone B and then by a smaller stone C Observe the change in length each time. Which of the stones A, B or C pulled it the maximum? Which stone pulled it the minimum? Looking at the change in length of the spring or the rubber string you can have an idea of the heaviness of the objects The heavier the object the greater will be the change in length of the spring or string. It is because the heavier object is pulled by the earth with a greater force. The greater the pull of the earth on an object the greater is its weight. Thus, the weight of a body is the force with which it is pulled towards the earth. The weight of an object is measured with a spring-balance

Frictional Force

You must have seen that if a ball is rolled on the floor, it stops after some time. You know that force is required to stop a moving body. Did you apply force on the ball to stop it? How then did the ball stop? When the ball moves, a force acts on it, which opposes its motion. This force is called frictional force. This force acts between the two surfaces which are in contact. In the above example, the two surfaces in contact are the ball and the floor. If a ball is rolled with the same force on a cemented floor and then on a *kachcha* floor, will it stop after covering the same distance? To get the answer to this question, you may perform a simple activity.

Activity 6

Take a piece of cardboard and keep it inclined using a brick as shown in Fig 6.22 Take a ball and keep it on the

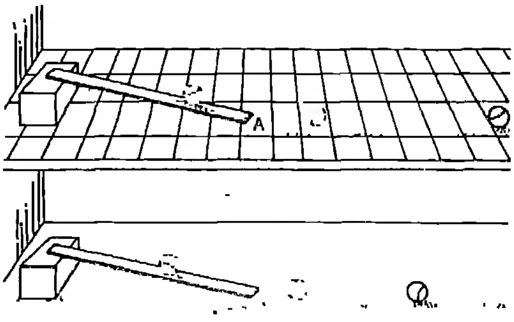


Fig. 6.22 *A ball rolls to different distances on a kachcha floor and a cemented floor, when the same force is applied*

cardboard Release the ball Let it roll down on the cemented floor Measure the distance the ball travels from A Repeat this activity on a *kachcha* floor and measure the distance the ball travels again. The ball should be released from the same point on the cardboard On which floor did the ball travel a larger distance? Since the cemented floor is smooth, the frictional force between the floor and the ball is less. Since the *kachcha* floor is rough, the frictional force between the floor and the ball is greater. Thus, the frictional force depends on the smoothness of the surfaces in contact

Friction may be disadvantageous to you.

Examples:

When you step on a banana skin you might slip because the banana skin reduces friction between the foot and the floor. (Fig. 6.23)

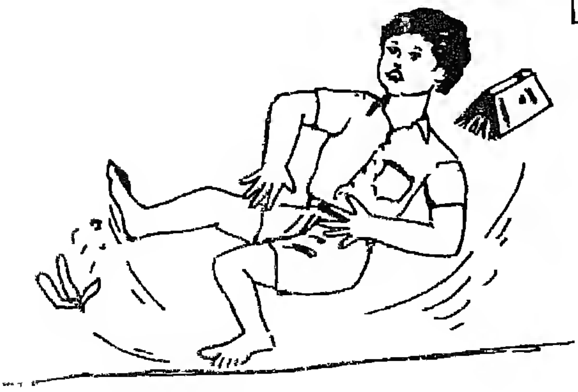


Fig. 6.23 *A child slipping on a banana skin*

Due to friction between the sole of the shoe and the floor, the sole wears out (Fig 6.24)

Machine parts which rub together, wear out (Fig 6 25)

Fig. 6.24 *The sole of a shoe worn out due to friction*

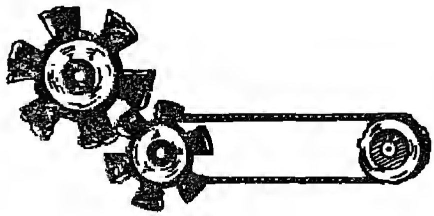


Fig. 6.25 *Machine parts wear out due to rubbing.*

Friction may be useful to you.

Without friction between pencil or pen and paper, writing and drawing would not be possible It would be impossible to cut wood without friction between the saw and wood The brakes of the bicycles and other vehicles would not work without friction between the rim and the brake-shoe The burning of match stick would not be possible without friction

Friction can be increased and decreased

You have seen that the frictional force is both advantageous and disadvantageous In some cases greater friction is required, which can be achieved by various methods Examples

(i) If the friction between the road and the tyres of automobiles and of bicycles is less, they will slip To increase friction grooves are made in the tyres (Fig 6 26)

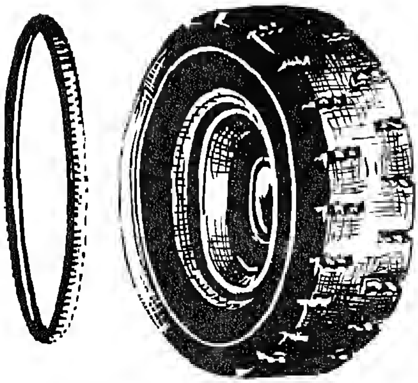


Fig 6.26 *Grooves in the tyres*

(ii) Greater friction is required between the moving parts such as the belt and wheel of a machine To increase friction special materials are used (You can see the material if you visit a flour mill near by)

(iii) Greater friction is required between the ground and the soles of the shoes worn by players and athletes To increase friction spikes are provided in the soles of the shoes (Fig 6 27)

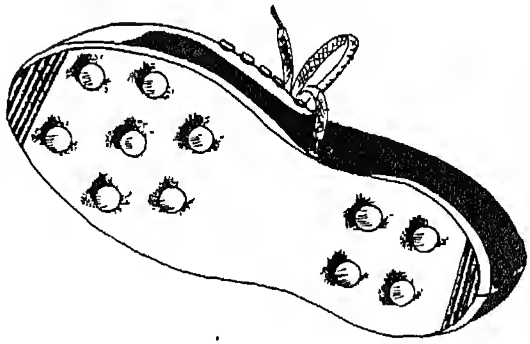


Fig. 6 27 *Spikes in the sole of shoes*

In some cases less friction is required Friction can be reduced by various methods Examples.

(i) Greater friction reduces the motion of the moving parts of machines. It also damages the machine parts which rub against each other To reduce friction such parts are lubricated using suitable oil or grease

(ii) Put a book on a table and try to move it as shown in Fig. 6.28. Now put the book on pencils or pea seeds as shown in the figure. You will find that it is easier to move the book when it is placed on pencils and pea seeds. The pencils and the pea seeds reduce the friction between the book and the table. This knowledge is used in making wheel ball-bearings and roller bearings. These are used in machines to reduce friction between the moving parts.

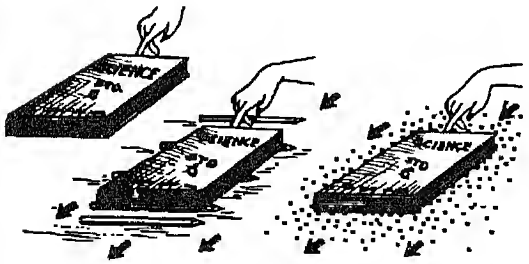


Fig. 6.28 *A book being pushed on a table, on pencils and on pea seeds*

6.3 *Machines*

There are a variety of machines which are used at home, in school, in playground and in many other activities of life. Why are the machines used?

With the use of machines our work becomes easier and faster. In situations where greater force is required you can do more work with the help of machines by applying less force. Machines can change the direction of force This makes our work convenient. (Fig 6.29)

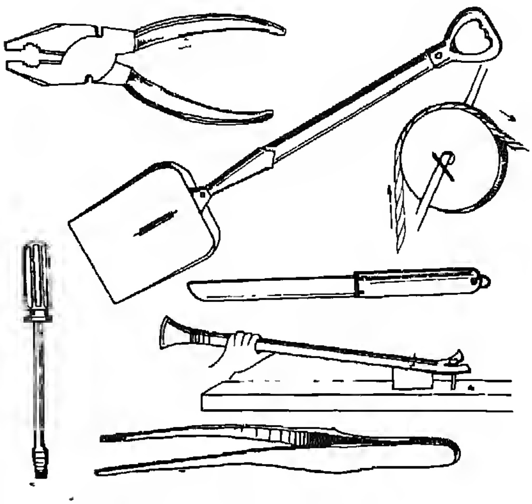


Fig 6.29 *Some simple machines*

You use different kinds of machines such as a knife, a screw, a pair of tongs, a pulley. These are some of the simple machines.

Some machines are complex. Complex machines are made up of a large number of simple machines. A bicycle, a sewing-machine, a tractor, etc. are some examples of complex machines (Fig. 6.30).

SIMPLE MACHINES

To lift or move a very heavy load from the ground, which of the two ways shown in Fig. 6.31 is easier?

A rod used in Fig. 6.31 is called a crowbar. The crowbar is an example of a lever. The object to be moved by the bar

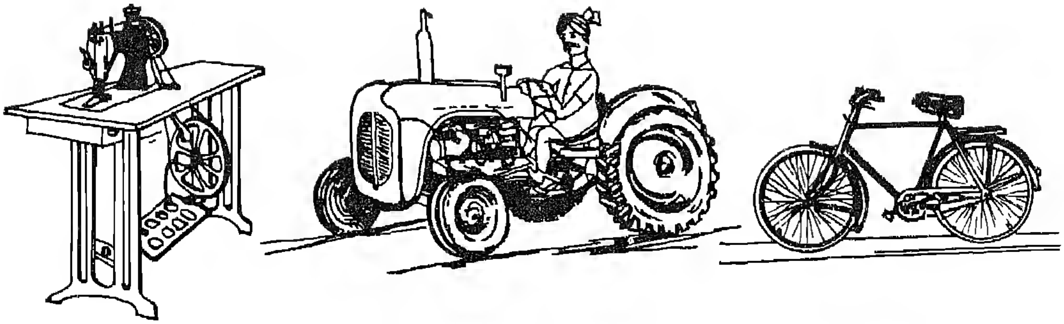


Fig 6.30 *Some complex machines*

is called *load.* The force applied to lift the load is called *effort* To use a rod in this fashion you need a support. This support is called *fulcrum* There are three types of levers

A strong spoon used in Fig 6.32 acts as a lever Note the positions of the load, the effort and the fulcrum The fulcrum is in the middle A beam balance, a see-saw, a pair of pliers are also examples of the levers which have fulcrum in the middle Those devices which have fulcrum in the middle are called the levers of the first type Draw a diagram of any lever of the first type and mark the positions of fulcrum, effort and load on it.

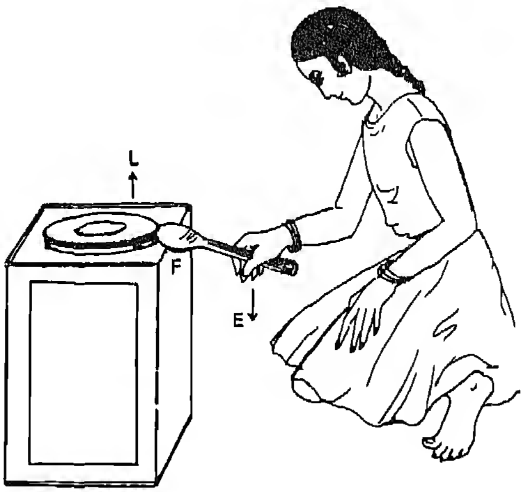


Fig. 6.32 *Spoon being used as a lever of the first type*

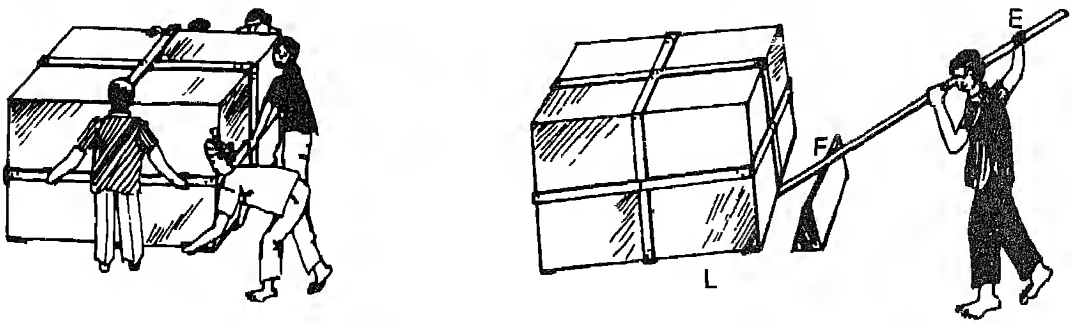


Fig. 6.31 *Two ways to lift a load*

The wheel barrow is a lever in which the load is in between fulcrum and effort (Fig 6.33). This type of lever reduces the effort which has to be applied to do the job. A bottle opener and a nut-cracker are examples of this type of lever. These are levers of the second type. Draw a diagram of a lever of the second type and mark the positions of fulcrum, effort and load on it.

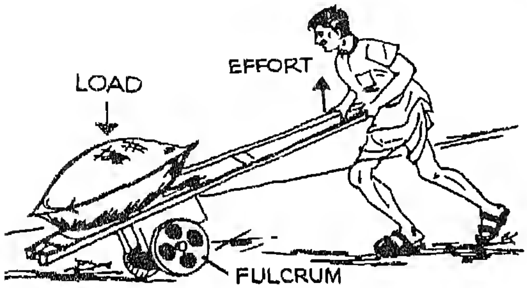


Fig. 6.33 *Wheel-barrow—a lever of the second type*

A pair of tongs is a lever in which the effort is in between the fulcrum and the load. A broom with handle and a fishing-rod are other examples of this type of lever (Fig 6.34). These are called levers of the third type. Draw a diagram of a lever of the third type and mark the positions of fulcrum, effort and load.

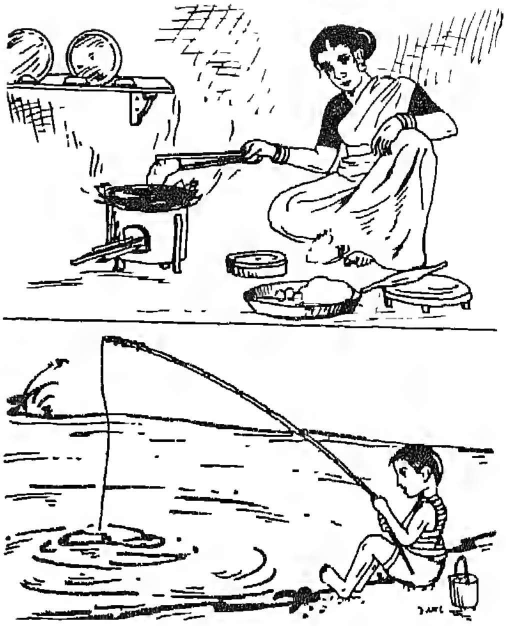


Fig 6.34 *A pair of tongs and a fishing-rod are levers of the third type*

Find out the various tools used in your environment. Classify them into the types of lever they belong to.

Look at Fig 6.35. Which one do you think is an easier method to load a drum of oil on the truck? A plank used in this

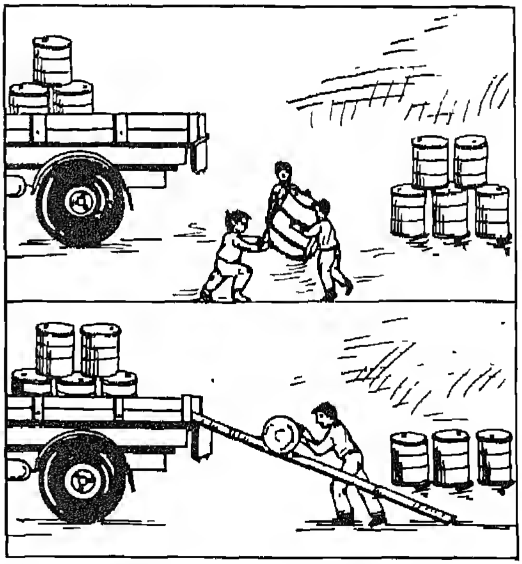


Fig. 6.35 *Two ways to load a drum on a truck*

way is called an inclined plane Some examples of the inclined plane are ramps and roads in hilly regions. The staircase in buildings is an example of an inclined plane with steps. A knife, an axe and a chisel are two inclined planes put together. The thread of a screw is also an inclined plane

Which do you think is an easier way to carry a box? Logs of wood are used to roll heavy loads The wheel too acts as a roller The wheel is one of the most important inventions of man. It is used in vehicles and in complex machines. Try to locate the wheels in machines around you. Also find the purpose they serve.

Most of the machines which you use in daily life such as the sewing-machine, the bicycle, the bullock cart are a combination of simple machines like levers, wheels, inclined planes and pulleys

MAINTENANCE AND CARE OF MACHINES

If a machine is to be used for a long time, it should be used carefully You have to take care of it Machines have iron parts in them Iron gets rusted To protect the outer parts of machines from rusting, they should be painted Some parts of machines rub against each other. If the friction between the moving parts is large, they will make harsh sounds. Besides, such parts wear out faster. Such parts therefore should be lubricated regularly

Machines need to be protected from dirt and dust to reduce wear and tear. When a machine is not in use, it should be covered If machines are maintained in this way, they will last longer and give you better service.

ANSWER THESE

1 Which of the following is not a function of machines?

   (i) To make our work convenient
   (ii) To enable us lift more load with less force
   (iii) To enable us make the measurements correctly
   (iv) To make our work faster

2 Complete the following statements

   (i) In the lever of the first type ________ is in the middle
   (ii) The pulley changes the ________ of force
   (iii) The point of support in a lever is called its ________ .
   (iv) The outer parts of machines are painted to protect them from ________ .

3 Classify the following levers as the first, second and third type. wheel-barrow, beam balance, crowbar, a pair of scissors, tweezers and lemon squeezer

4 Why is the oiling of some parts of a machine necessary?

YOU NOW KNOW

— When a body moves, it changes its position with time.
— There are various types of movements such as linear, circular, oscillatory, periodic and random.
— Some objects may have mote than one type of motion at the same time
— Speed is the rate of change of the position of an object.
— Speed can be changed by applying force
— Force is push and pull
— Force can change the speed, the direction of motion and the shape of an object
— There are various types of forces such as muscular, magnetic, gravitational, electrostatic and frictional
— Frictional force opposes motion
— Friction can be both advantageous and disadvantageous
— Friction can be increased or decreased.
— Machines make our job convenient, easier and faster
— Lever, pulley, inclined plane and wheel are simple machines
— The arrangement of load, effort and fulcrum is different in different types of levers.
— A pulley provides us convenience by changing the direction of force
— Complicated machines are made up of a number of simple machines
— Machines need care and maintenance.

NOW ANSWER THESE

1 Name three effects of force
2 A boy riding a bicycle covers a distance of 10 m in 40 s What is the speed of the boy?
3 A girl is sitting in a moving merry-go-round What type of motion is she having?
4 In the following statements write 'T' against those statements which are true and 'F' against those which are false.

(i) The point at which a lever is supported is called its fulcrum.
(ii) A pair of tongs is an example of lever of the second type
(iii) It is easier to roll a heavy drum on an inclined plane than carrying it up directly.
(iv) A sewing-machine is an example of a simple machine.
(v) A crowbar helps you shift a heavy load faster
(vi) A pulley fixed on a well helps in drawing more water with less effort

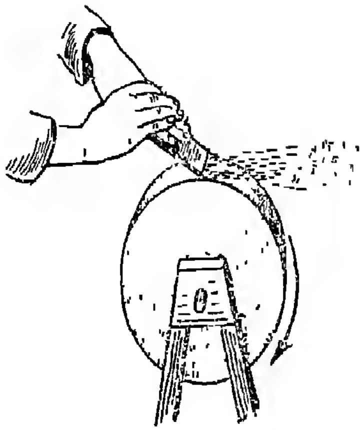
5 Which of the following is not an example of force of gravity.
(i) A leaf falling from a tree
(ii) A boy pushing a cart on a level plane.
(iii) A diver jumping into a swimming-pool
(iv) A stone falling from the top of a cliff.

6. Which of the following is not an example of muscular force.
   (i) A porter carrying a load on a wheel-barrow.
   (ii) An apple falling from a tree
   (iii) A child riding a bicycle
   (iv) A person drawing water from a well

7 Draw a lever and mark the positions of load, effort and fulcrum on it. Which type does this lever belong to?

8 What are the different types of forces. Give an example of each

9 Classify the following as linear, circular and oscillatory motion
   (i) The motion of a cyclist on a straight plane road
   (ii) The motion of a plucked string of a *sitar*.
   (iii) The motion of the tip of the hand of a clock
   (iv) The motion of the earth around the sun
   (v) The motion of a falling stone.
   (vi) The motion of a swing



The Living World

THERE IS A VARIETY of living organisms around you Each one of the organisms possesses a definite shape, size, some kind of structure and a colour pattern. How do they vary? Some organisms are found on land, some in water You must have seen birds and insects flying Each animal has a preference for a particular kind of home. Some build nests, some live in caves, some live in the holes of trees, some make webs and some live in our homes. These organisms vary even in their food habits. Some eat only plant material, some eat smaller animals There are certain animals which eat both types of food Each organism can be identified

7.1 *Variety in the Living World*

VARIETY IN SHAPE

Activity 1

Look at Fig 7 1 Try to classify the organisms according to their shapes

Try to roughly match them with any of the given geometrical shapes (Fig 7 2)

A careful observation will help you find out that some of these forms are elongated, some are round, some are star-shaped How many other shapes can you count besides these? In the diagram, only 25 of the one and a half million kinds of organisms are shown Still, you find that there are many forms which you cannot classify according to any definite shape Imagine what a great variety of shapes must be there in the whole of the living world

VARIETY IN SIZE

Activity 2

Collect some water in a bottle or jar from a stagnant puddle or pond nearby Take a drop of water on a glass-slide, put a cover slip and observe it with (i) the naked eyes, (ii) a hand lens or magnifying glass, and (iii) under a microscope

Do you see anything? What do you see in each case? Note down your observations.

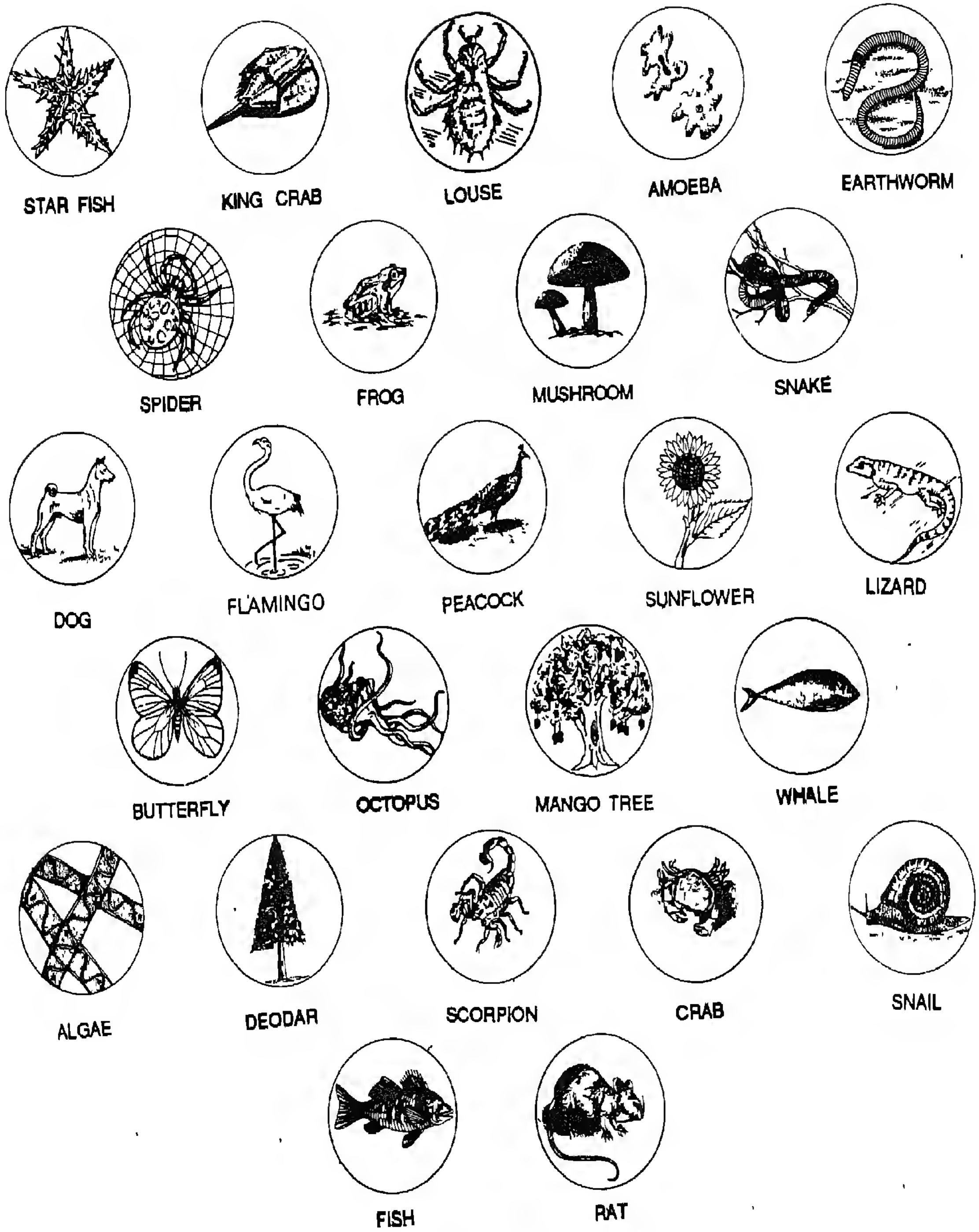


Fig. 7.1 *A variety of plants and animals*

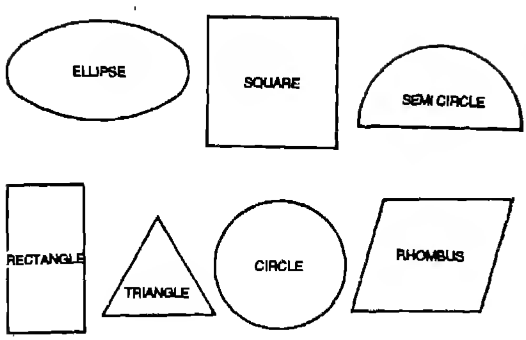


Fig. 7.2 *Some common geometrical shapes*

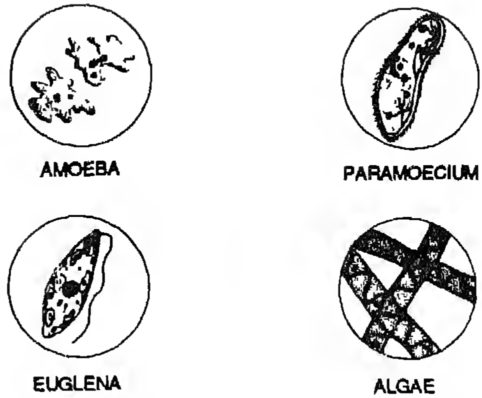


Fig. 7.3 *A few microscopic animals*

Look at Fig 7.3 and find out which forms you saw under the microscope

In the living world we find organisms of various sizes. Some are so tiny that we cannot see them without a microscope You might have seen a few of these in the drop of water under the microscope (Fig. 7.3)

Which is the biggest living organism you can think of? You may think that the largest animal on land is the elephant. But do you know that the largest animal in the world lives in the sea and is called the blue whale The blue whale weighs almost as much as 30 adult elephants! (Fig 7.4)

VARIETY IN FOOD

Do all the living forms eat the same kind of food? No. There is a large variety of food available on the earth and each type of organism has a different choice of food. There are some forms which have choice for the same food. Think of some animals which eat the same food.

Activity 3

What kind of food do the following animals eat?

Sparrow	Elephant
Rabbit	Vulture
Tiger	House Lizard
Frog	Fish
Honeybee	Rat
Goat	Bear
Ant	Snail

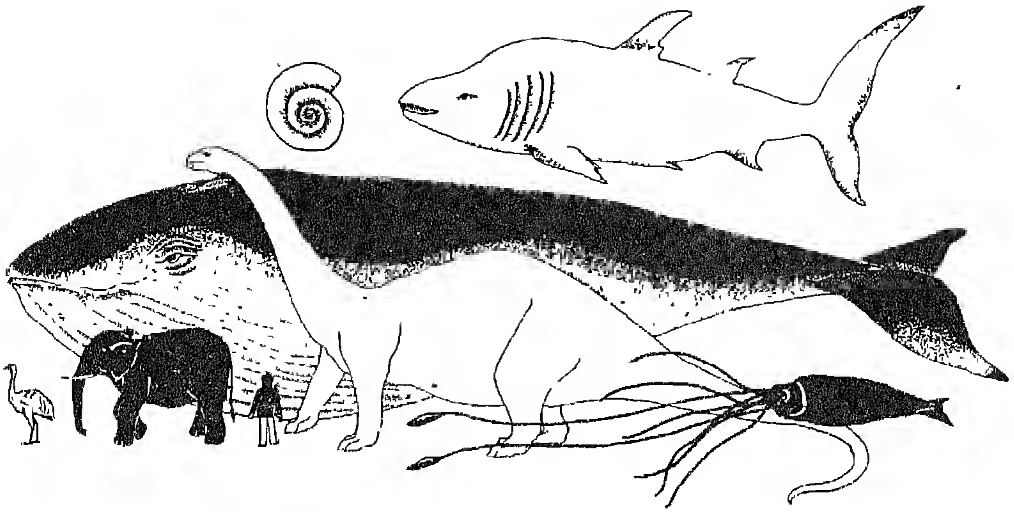
The living objects need different types of food, according to their life-styles and habits. Do plants eat or produce food? The green plants manufacture their own food.

VARIETY OF ANIMAL HOMES

All human beings need houses for shelter and protection. What do animals do for shelter and protection?

Activity 4

Where do these animals (p. 96) live?



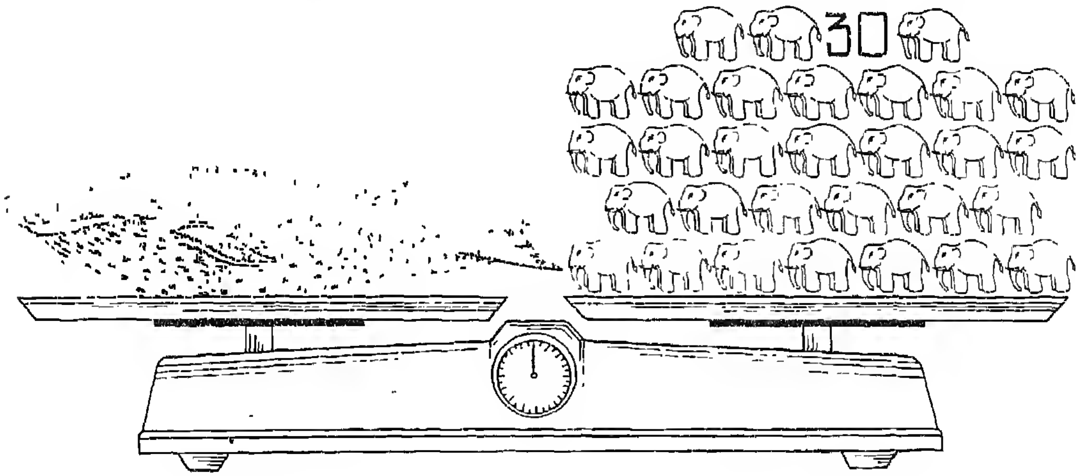


Fig 7.4

Termite	Pigeon	Crocodile
Snake	Cockroach	Rat
Lion	Weaver-bird	Shark

Have you ever tried to find out where exactly ants live? Although we see them moving around in the house as well as in the garden, the ants live underground

Have you seen a termite nest? They are usually seen in the fields or forests Termites are also seen in homes where they damage wood or paper by chewing them

How do these termites live? They live in a large colony All the members of the colony live in the same nest A part of the nest is underground and the

rest of it can be seen above the ground. The nest is made of soil Soil mixed with the saliva of termites holds the nest firmly

Termites, ants, earthworms, rats and several other animals make their homes in the soil. They do not like light What other reasons can you think of? Can you think of some more animals which do not like light?

VARIETY OF HABITS

Activity 5

If you happen to find an earthworm, hold it carefully Bring it to your home or school If you have a table-lamp, keep it near the lamp Does it try to go away from light?

Take a glass-tube (Fig 7 5) open at both ends Wrap half the tube with black paper Put the earthworm in the tube from one side. Which side of the tube does the earthworm go to? Put the earthworm from the other side of the tube Note your observations.

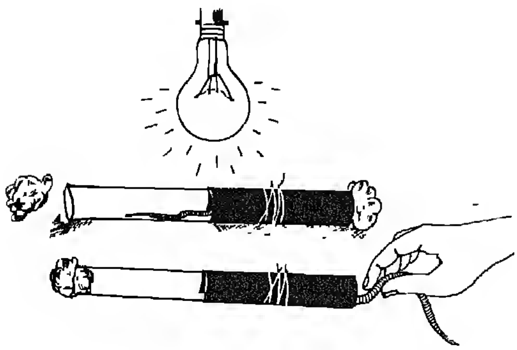


Fig 7.5

There are certain animals such as moths and some types of beetles which are attracted by light Can you name some more?

There are certain animals which come out only during the night, move around and also eat mainly during the night Example earthworm, mosquito, moth, owl Some animals prefer daylight and are active during the day. Example Housefly, butterfly, sparrow, crow

Activity 6

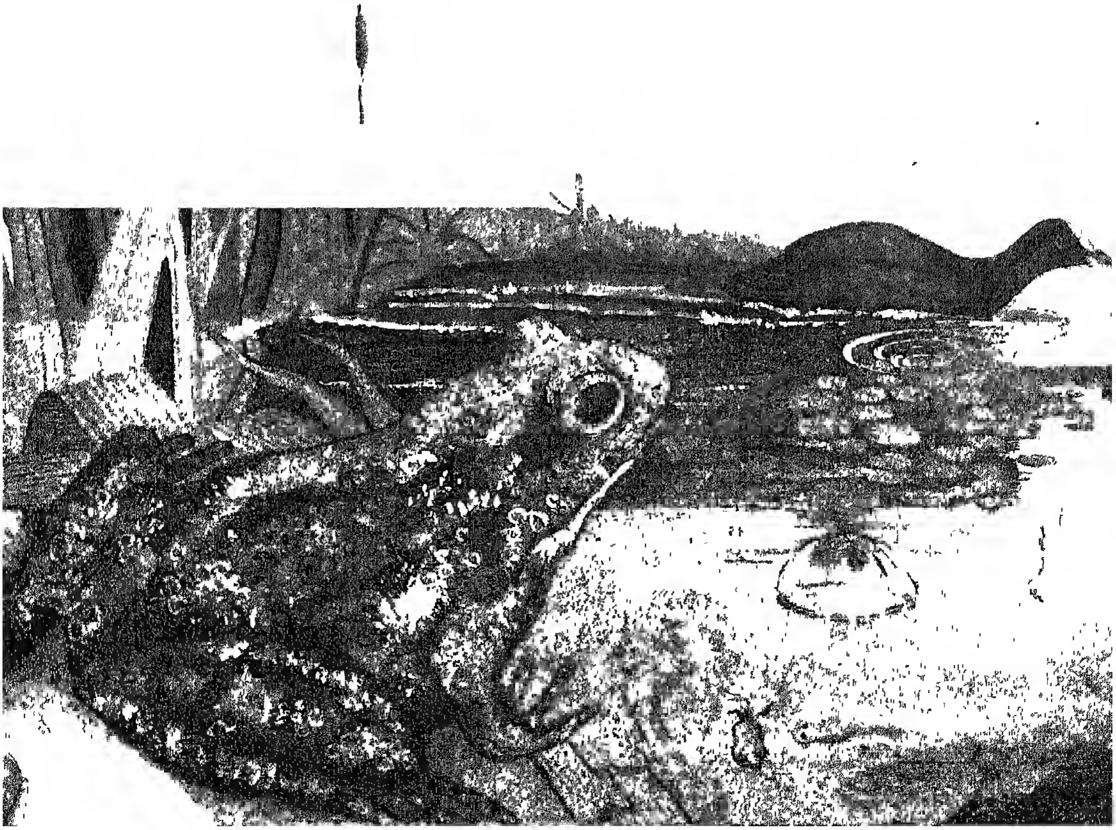
Which of the following animals are active during the night and which in the day time?

Rat	Sparrow
Parrot	Firefly
Honeybee	Owl
Eagle	Hyaena

THE HABITAT

All animals prefer to live in the places where food is available in plenty and which are safe for them and their babies These places are called habitats. A pond is a habitat, a forest is another habitat and the sea-shore is also a habitat. Plants grow better and survive longer in a particular environment Some plants grow in water, e g lotus Some plants prefer to live in dry areas, e.g cactus Can you think of some more plants which can live in either of these habitats?

Fig. 7.6 *The pond is a habitat*



Activity 7

Try to visit a nearby pond Make a list of all the living objects you see in and around the water If you cannot name them, try to draw them. Describe their colours and other noticeable features

Look carefully at the plants around the water Observe the soil near the water Do you see anything on the surface of water? What animals do you expect under the water?

All the animals and plants that you notice in and around the pond are sharing one and the same habitat—the pond

You may find frogs, turtles, fish, water spiders, water-skaters, microscopic organisms, snails, dragon-flies, kingfishers, herons, ducks and many other types of animals inhabiting the pond. Also many types of plants such as alga, water lily, hydrilla, waterhyacinth, and some weeds grow in the pond (Fig 7.6)

Even though several living organisms share the same habitat, their food habits are different. Hence, these organisms face less competition for food. This fact is advantageous for their survival

SPECIES

You know various kinds of organisms, such as man, cat, cow, cockroach, paddy, neem, pine and mango. Each kind has many individuals You may find some differences among the individuals of a kind But, still, the individuals of a kind have enough similarities by which they can be recognized as cockroach, cow, paddy, neem, pine and mango They have similarity of body parts and their functioning They eat the same kind of food and live in the same habitat They cooperate among themselves for reproduction Such a group of similar individuals is known as species Each species has a name How are the species named scientifically?

Most of us have proper names and surnames (family name) to identify ourselves individually and as members of a family Each plant and animal has a scientific name written in two words The scientific names help us in identifying each type of plant or animal and also the group to which it belongs Although in different languages the plants and the animals are called by different names, their scientific names are the same all over the world

When the scientific names are written, the first letter of the first word (group name) is always written as a capital letter but the first letter of the second word (individual name) is written as a small letter

Example

Indian Tiger	*Panthera tigris*
Peacock	*Pavo cristatus*
Human	*Homo sapiens*
Mango	*Mangifera indica*

Do you know that the tiger is the national animal and the peacock is the national bird of India?

> There are over 1,200,000 species of animals and 300,000 species of plants in the world today. Many of these are being destroyed by the human activities. One in five of all living species may be extinct (will be no more on the earth) by A D. 2000

We have seen that living organisms are very different in shape, size, habitat, food habits and behaviour They breathe in different ways and also move around in different ways They even have different ways of growing and reproducing themselves. All have different names. But in spite of all these differences, they all have one most important thing in common—they are all LIVING

THE LIVING WORLD

ANSWER THESE

1. Name the largest animal in the world
2. Which is the biggest land animal?
3. What kind of food do the following animals eat?
   frog, ant, vulture, sparrow, fish, honeybee
4. Where do the following animals live?
   snake, bear, cockroach, elephant
5. Give an example of two animals which are active during the night.

7.2 *Living Organisms Have Some Common Characters*

The living organisms share some features with the non-living objects. You might wonder how. All living and non-living objects are made up of matter They all have mass and occupy space. (See Unit Two) |

Life is the process seen only in the living objects in the form of growth, movement, feeding or eating, sensitivity, respiration, excretion and reproduction (Fig 7 7)

LIVING THINGS GROW

Some living forms grow continuously for some period of their life (Fig. 7 8) and some during the whole period of their life-cycles

Animals do not grow after an age but plants grow throughout their life.

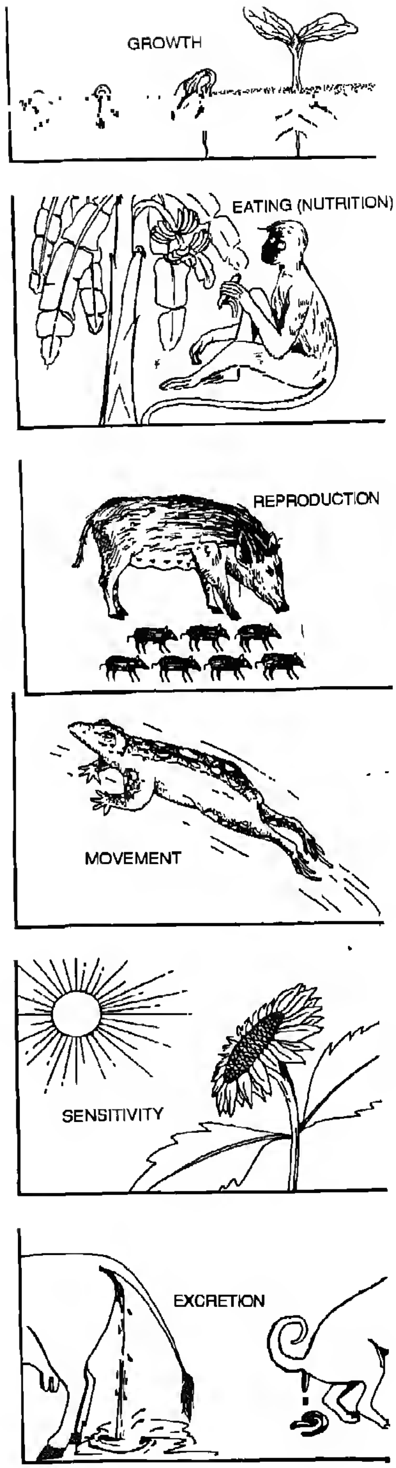


Fig. 7.7

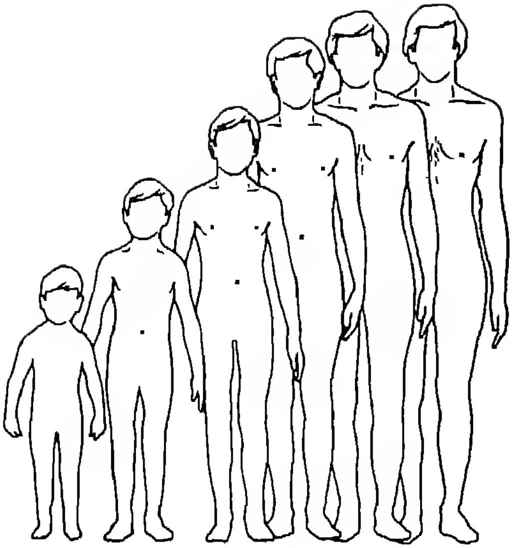


Fig 7 8 *Man grows only up to a definite age*

All living objects start their life as they are born as babies, or hatched from eggs or produced from seeds or spores They all grow into adults and die eventually But some organisms live far longer than others Certain bacteria may survive a million years or even more, if frozen or buried under salt Animals have a varied life span (Fig. 7 9) but most of the large trees live longer than animals

LIVING OBJECTS HAVE A DEFINITE LIFE SPAN

Every individual organism has a definite beginning of its life It remains alive for some time and then it dies Different kinds of organisms have different average duration of life

LIVING THINGS ARE MADE UP OF CELLS

Activity 8

Take an onion Separate the thin inner layer of any fleshy layer you can easily peel off by using your fingers Place a piece of this layer on a glass-slide Put a drop of water and cover it with a cover-slip. Observe it under a microscope. Draw the structure that you see (Fig 7 10) All living organisms are made up of cells which are of different shapes and sizes and perform different functions

Open your mouth and lightly scrape the inner part of your cheek with a finger Put the scraping on a glass-slide Add a drop of water, put a cover-slip on it and observe it under a microscope Make a drawing of the cheek cells (Fig 7.11) These are one type of animal cells

All the visible living objects are made up of hundreds of thousands of cells Even the microscopic organisms are made up of one or more cells Some plants and animals consist of only a single cell For example, Amoeba, Paramoecium, Bacteria, Yeast

Most plants and animals are made up of millions of cells. Do you know that a new-born baby has at least 2,000 million cells (i e 2,000,000,000 cells)?

ANSWER THESE

1 What is the scientific name of man and mango?
2 What are the main characters of the living objects?

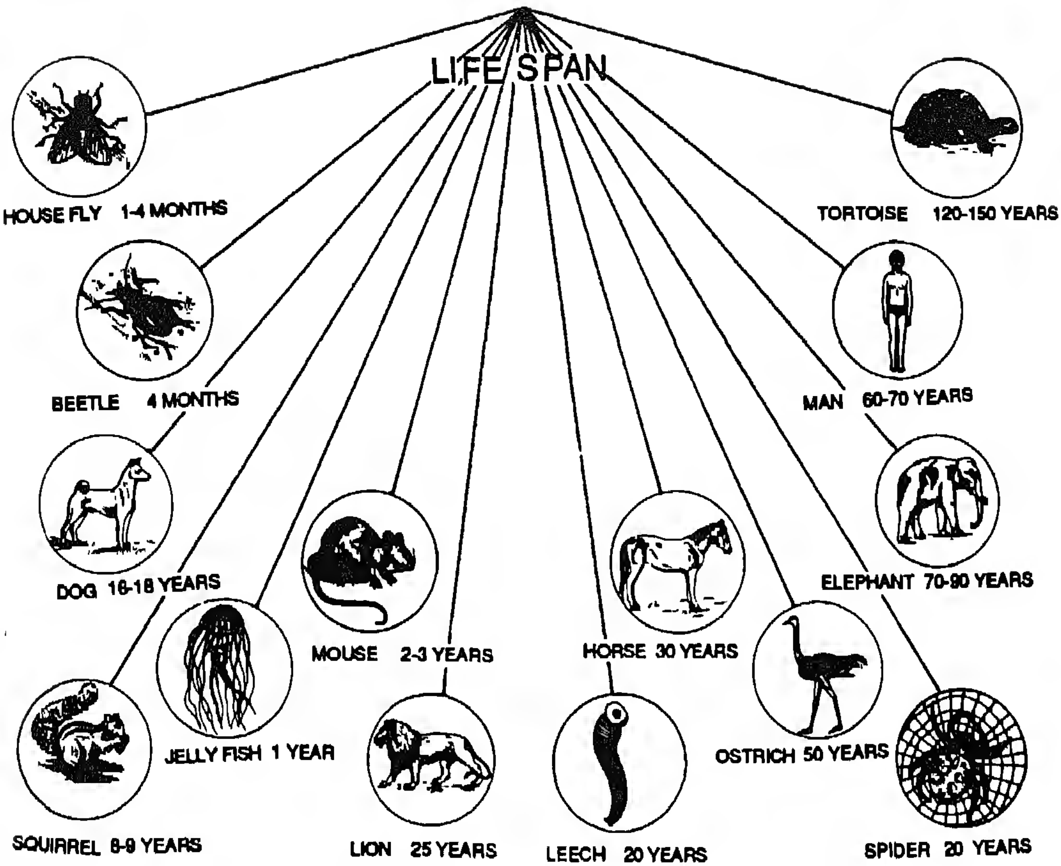


Fig 7.9 *Different organisms have different life spans*

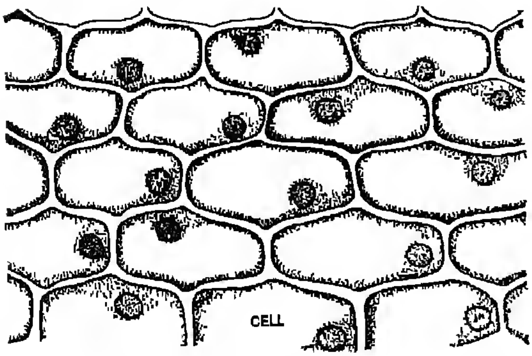


Fig. 7.10 *Cells of the onion peel*

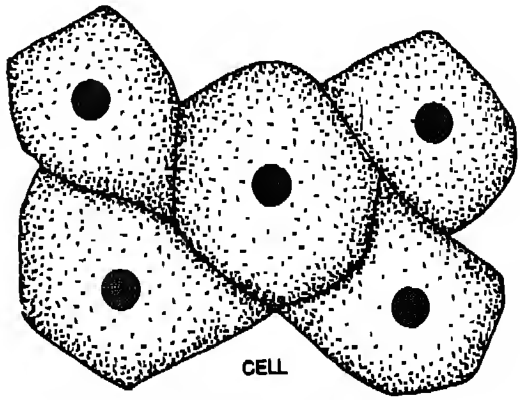


Fig. 7.11 *Human cheek cells*

3 Name some organisms whose body consists of only one cell.
4 How are plants different from animals?

7.3 *Classification of Living Forms*

You have learnt that there are similarities as well as dissimilarities between plants and animals Plants differ even from the other plants Similarly, animals differ from other animals.

Activity 9

Make a list of five plants and five animals. Observe them and answer the following questions.

What do these five plants have in common?

How do these five plants differ from one another?

What do these five animals have in common?

How do these five animals differ from one another?

What are the main differences between the plants and the animals?

There are certain special characteristics of each living form On the basis of these, they are classified as definite groups.

PLANTS AND ANIMALS

The world of living organisms can be divided into two groups—PLANTS and ANIMALS

An important difference between plants and animals is the way they obtain their food. Most animals, being able to move about, obtain food by looking for and going after it Most plants are fixed They manufacture their own food The process by which they manufacture their food is called photosynthesis

Plants and animals reproduce themselves. They produce one or more individuals of their own kind

Plants reproduce mainly through seeds or spores Certain plants reproduce through leaves Example *Bryophyllum*. Some also reproduce through stems. Example· ginger, potato:

Animals reproduce by laying eggs, by just dividing themselves into two parts or by giving birth to babies

Plants, like animals, have definite organs Each part plays its own particular role

Both plants and animals are able to respond to changes in their surroundings These changes which they respond to, are called stimuli

Now let us see how plants and animals are classified further. The most appropriate classification of living objects is on the basis of their structure

Do you know?

Some plants can move from one place to another e.g , *Chlamydomonas, Volvox*.

Some animals remain fixed at one place e.g., sponges, sea anemone, corals

Some plants are not green e.g. fungi.

Bacteria are very small one-celled plants.

Viruses are living objects (smaller than bacteria) which share the characters of the living and the non-living

Fig 7.12 *A flowering plant*

CLASSIFICATION OF PLANTS

Plants can be classified as different groups on the basis of certain characters.

Each plant has its own special features which help us to identify it Generally speaking, plants can be divided into two main groups—the flowering plants and the non-flowering plants

(i) Flowering plants. These plants have roots, stems, leaves, flowers and fruits (Fig 7.12)

(ii) Non-flowering plants. These plants do not bear flowers (Fig. 7.13)

Fig 7.13 *Some non-flowering plants*

Flowering plants are further classified as certain groups How would you find out which type of plant it is?

Plants may be trees, shrubs or herbs

Trees are tall and large plants with hard and woody stem They have one main stem—the trunk which generally gives out branches and leaves (Fig 7 14)

Palms are also trees They are never branched. The coconut tree is a type c palm tree

Shrubs are medium-sized plants with a hard and woody stem They are often branched Many branches are seen rising just above the ground (Fig. 7.15)

Herbs are small plants with a soft stem They do not grow more than three to four feet in height. (Fig. 7 16)

Some non-flowering plants do not have distinct roots, stems, branches or leaves.

Activity 10

Observe some algae under a microscope. You can find algae growing in any damp place near water, in ponds or in water tanks. Draw its structure. Do you see any definite parts or organs of algae? Do they have stem, leaves or roots?

Activity 11

Observe the bread mould—without a microscope and under a microscope Draw the structure Compare it with that of a flowering plant. Do you see any roots, flowers or leaves? Do you see several tiny black or brown spots? What are these?

CLASSIFICATION OF ANIMALS

Animals can be classified on the basis of some characters We can identify various

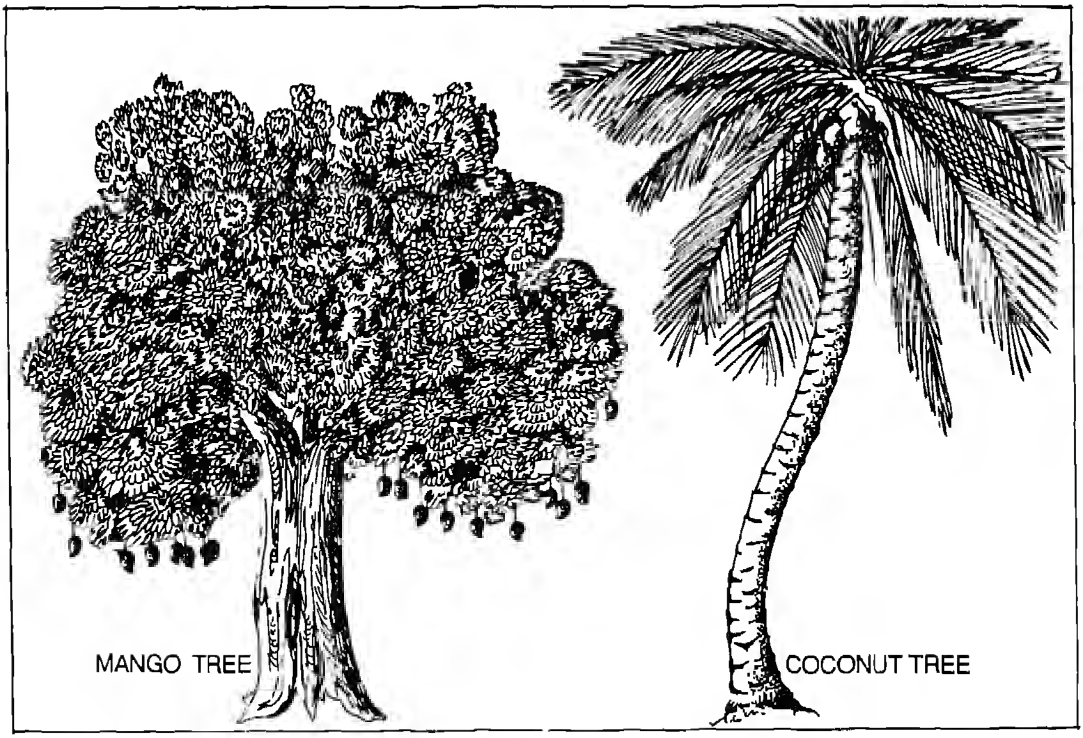


Fig. 7 14

Fig. 7.15

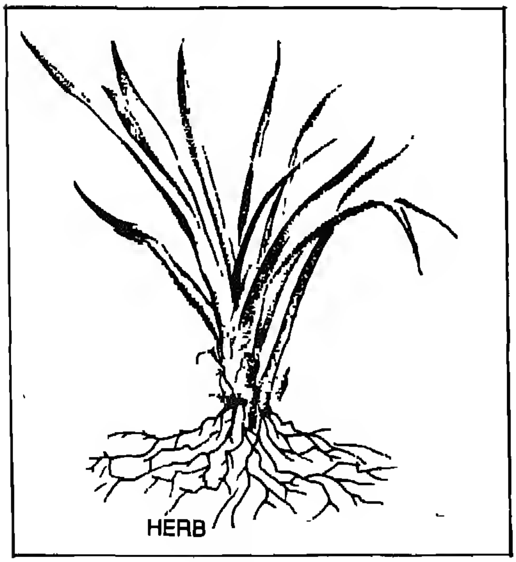


Fig. 7.16

kinds of animals on the basis of their characters.

Can you classify the animals shown in Fig 7 1 in certain groups? How would you do it? Where would you begin?

There are many possible ways You can separate all the animals into two main groups—vertebrates and invertebrates

The animals with a backbone are called *vertebrates*

Inside the body of some animals there is a bony skeleton (Fig 7.17). The backbone is a part of the skeleton. The backbone is made up of several small bones called vertebrae.

The animals which have no backbone or bony skeleton, are called *invertebrates*. (Fig 7.18)

What about you? Would you call yourself a vertebrate?

Animals can also be classified according to their body coverings They have their bodies which suit their environment

Some animals have scales, some have hair, some have spines, some have slimy skin, whereas all the birds have feathers Can you think of any other type of body covering? Group the animals on the basis of their body coverings.

Animals reproduce their young ones

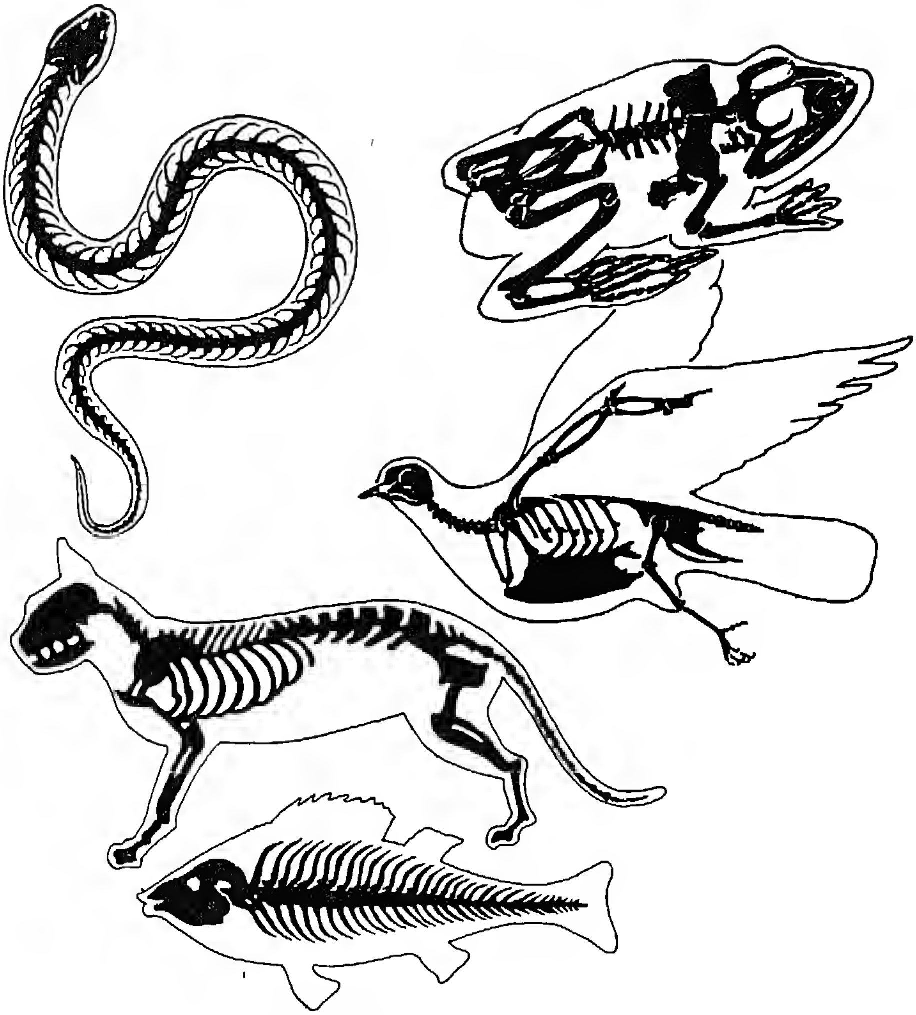


Fig. 7 17 *Vertebrates have hard skeletons.*

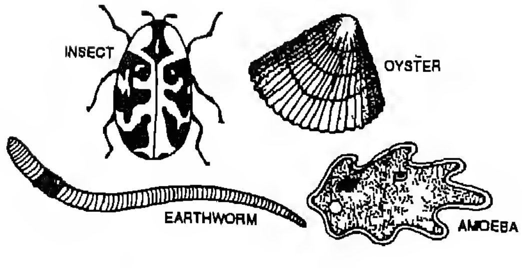


Fig 7 18 *Some invertebrates*

in different ways There are some animals as amoeba, paramoecium and hydra which produce new individuals of their type just by dividing their bodies Can you think of some more animals of this type? Can you name five animals that lay eggs? Can you name five animals that give birth to young ones?

ANSWER THESE

1. Name some plants without root and shoot systems
2. List five animals of each group having different body coverings:
   (i) Animals which have scales on their body
   (ii) Animals which have slimy skin
   (iii) Animals which have feathers
   (iv) Animals which have hair on their skin

YOU NOW KNOW

— There is a great variety of living things around us.

— Living things differ in size, shape, structure, food habits and habitats

— Living things which are similar in habits, habitats, structure and ways of living, form one species. Each species has a name

— All living organisms have some common characteristics

— All living organisms carry out certain processes such as respiration, digestion, reproduction, excretion and response to stimuli

— Living things can broadly be divided into plants and animals

— Plants can be classified on the basis of certain characteristics

— Animals can be classified on the basis of certain characteristics

NOW ANSWER THESE

1. How do plants obtain their food?
2. What is a habitat?
3. Match the animals/plants with their respective habitats

octopus	desert
hydrilla	forest
cactus	sea
tiger	pond

4. Tick the animals which can live in water as well as on land

frog	duck
crocodile	human
fish	monkey

5. What are the similarities and dissimilarities between plants and animals?
6. How can plants be classified?
7. Classify the following as herbs, shrubs and trees.
   jasmine, rose, palm, mustard, radish, canna, neem, mango, sunflower, tulsi, coconut
8. How do you classify the animals?
9. Can you name the national bird of India?

   Can you name the national animal of India?

10. Fill in the blanks.

    (i) The animals which do not have the backbone or bony skeleton are

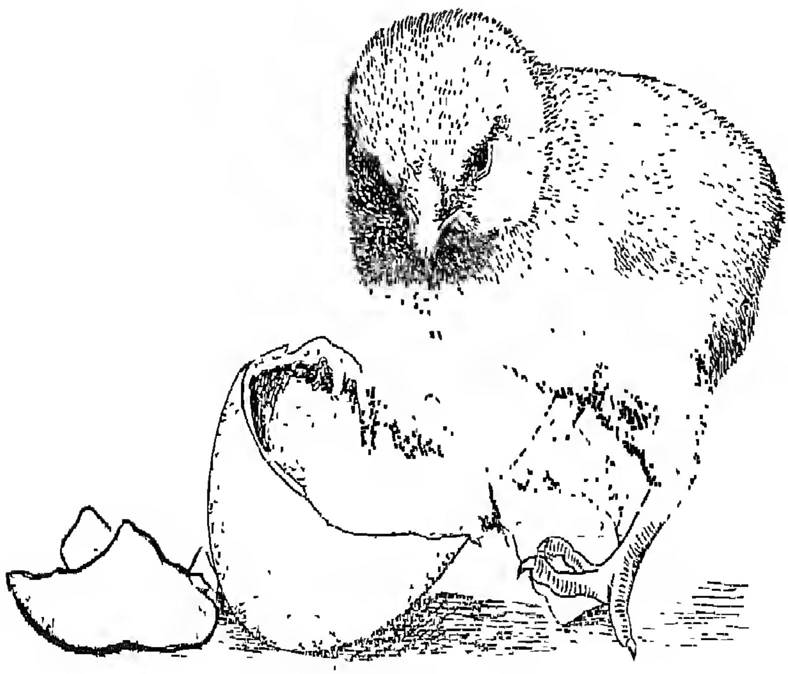
called ________________________ (vertebrates/invertebrates).

(ii) Canna is a __________ and teak is a ________________________ (herb/shrub/tree)

(iii) Mushroom is a ____________ plant (non-flowering/flowering)

(iv) The scientific name of lotus is___

(v) The common name of *Homo sapiens* is ________________________



Structure and Function of the Living Body

YOU KNOW that all animals have different organs to perform various functions Some of these organs are seen from outside, such as eyes, ears and limbs, whereas the other organs cannot be seen from outside as they are within the body, such as kidneys, lungs, stomach, etc.

Each organ of the body has a special function to perform. The ears are organs of hearing They also help in balancing the body. The eyes help in seeing things It would be interesting to know these organs and the way they function. How do different animals and plants use their organs to feel their surroundings and also to survive successfully?

Each part of the body of an animal or plant is different in structure The organs, however, function in coordination with one another

8.1 *Specific Parts of Plants*

Look carefully at each plant that you see around When you look at a plant, what parts can you see above the ground? You know that plants have roots, stems, leaves and flowers as well as fruits.

Let us find out what type of function each of these parts performs for the plant Plants have two main systems—the root system, which grows mainly underground, and the shoot system, which is above the ground

THE ROOT SYSTEM

Certain root systems have a main root called the tap root It grows vertically down into the soil The tap root gives out branches [Fig 8.1(a)]

Example pea, neem, mango

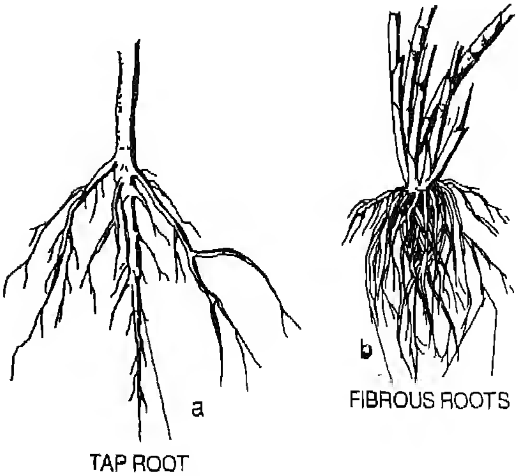


Fig 8.1 *The root system*

Some plants do not have any main root They have many fibre-like roots These are called fibrous roots [Fig 8.1(b)]. These roots spread out in the soil and give firm support to the plant Wheat, grass, maize and millet have this type of fibrous root system Thus root systems are of two types (i) tap root system and (ii) fibrous root system

As roots grow normally underground, they fix the plant to the ground They absorb the mineral salts and water from the ground, which are needed for the plant to grow

Roots also help hold the soil together. They save the soil from being blown off or washed away.

Different plant parts are often modified to perform additional functions.

Roots for Storage of Food

Activity 1

Observe carefully the roots of the sweet potato, beet or carrot Are they different from the roots of other plants? In what way are they different?

You might have observed that the sweet potato, beet and carrot have swollen roots (Fig 8 2) These roots contain food which is stored by the plant. The plant uses this stored food when it needs We also eat some of these roots Can you name some other roots that we eat?

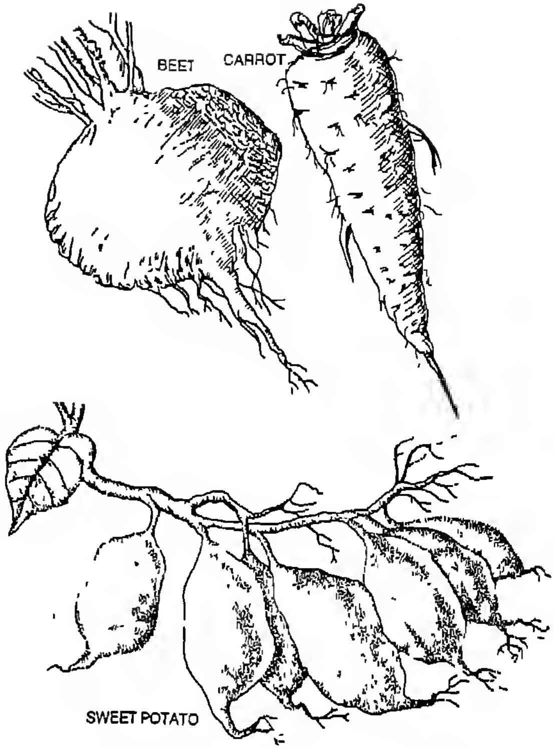


Fig. 8.2 *Roots modified for storage of food*

Roots for Additional Support

Observe a banyan tree if there is one in your locality Do you see rope-like growths hanging down from the bigger branches? Do some of these growths penetrate into the soil? Do you find some which are almost as thick as the tree trunk? (Fig. 8.3). Do you know that these are also roots?

They support the heavy branches Besides the banyan tree, the maize plant also has supporting roots

THE SHOOT SYSTEM

The shoot system grows above the ground It consists of the main stem, its branches and leaves

The Stem

The stems have nodes and internodes The stem of a plant is the link between the roots and the leaves and flowers In most plants, the stem holds the plant upright (Fig. 8 4). The stem is the strongest part of a tree and is known as the trunk Most trunks are covered with bark The bark protects the inner part of the tree The stems of some plants are weak They cannot stand erect

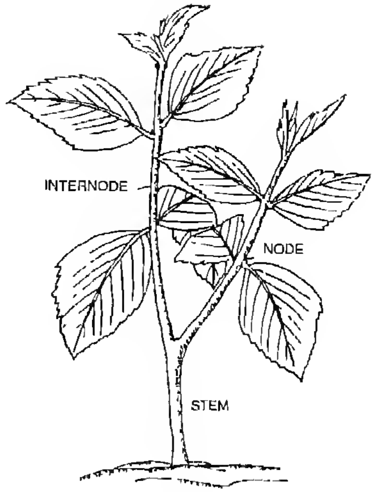
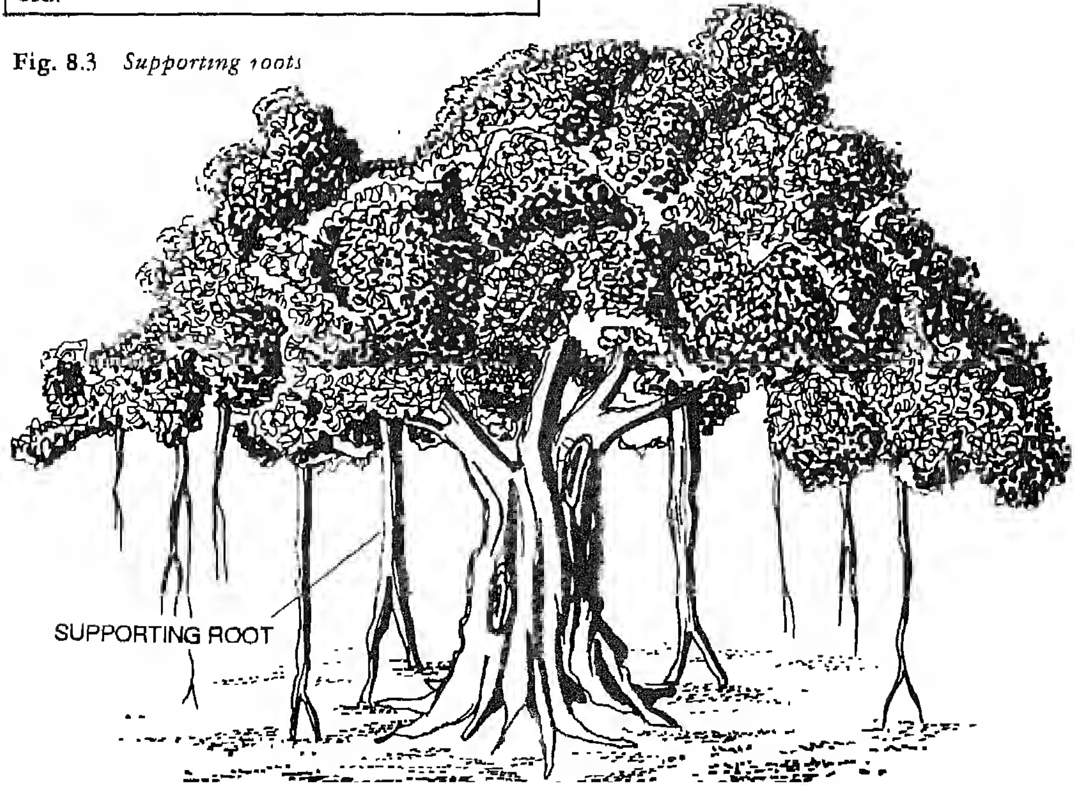


Fig 8.4 *Shoot system*

The largest plant in the world is a redwood tree in California This tree has been given the name 'General Sherman' Its trunk is more than 80 metres high. It is about 30 metres at its base. It may be more than 3,500 years old.

Fig. 8.3 *Supporting roots*



Stems carry water from the roots to the leaves and flowers They also carry food from the leaves to other parts of the plant. They hold the leaves in such a way that the leaves get plenty of light from the sun

Activity 2

Take a cutting (the stem along with leaves and flowers) of a plant with thin leaves like balsam or *Vinca (baramasi)*. Put some water in a glass Add a few drops of red ink in the water Place the cutting in the coloured water Leave it there for a day Observe what happens Into what parts did the water go? How did the water travel?

Modified Stem

Activity 3

Study a potato, a piece of ginger and an onion cut into halves (as in Fig 8.5). Do you think these are roots? In fact, these are not roots; they are stems. They also have nodes, internodes and scales (leaves).

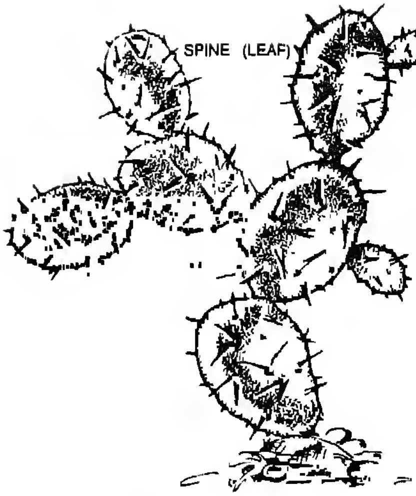


Fig. 8.6 *Cactus*

They grow underground and are storehouses of food material.

Activity 4

Observe a cactus plant. Can you see any leaves? The fleshy stems of cactus store water for long dry periods The green stem performs all the functions which leaves perform in other plants. (Fig. 8.6)

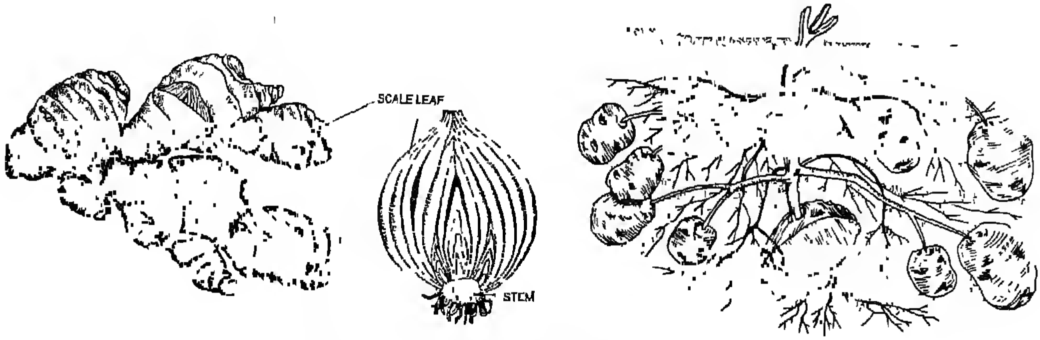


Fig 8.5 *Underground modified stems*

The leaves are in the form of spines, which reduces loss of water from the plant Thus, the plant survives in hot and dry areas

Activity 5

Examine the stem of a passion flower, gourd or grape-vine Do you see any small growths from the stem? How do these help the plant?

These small thread-like growths are called tendrils (Fig 8 7) They are tiny, wiry, coiled and leafless The stem is weak and cannot support the weight of the plant Tendrils help the plant climb by coiling around any neighbouring object

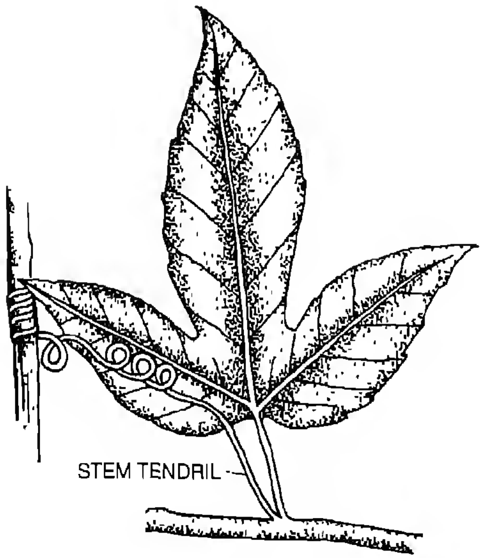


Fig. 8.7 *Stem tendril*

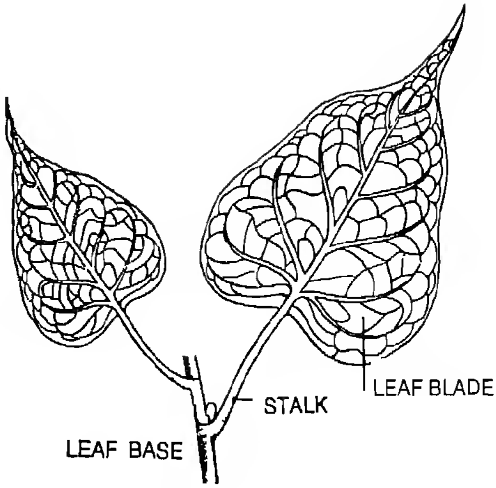


Fig. 8 8 *Parts of a leaf*

The Leaf

The leaves are usually flat and green Look at the leaves of a neem tree. Compare them with the leaves of a mango tree, of a eucalyptus tree and of any other plant that you find in your locality

Leaves are important parts of plants Look at the different parts of a leaf in Fig 8 8 The leaves manufacture food for the plants Do you know why leaves have green colour? Leaves are green because they have green pigments. These pigments are called chlorophyll To make food, the green leaves need sunlight, air and water. The process of making food in the presence of sunlight is called photosynthesis

After seeing so many types of leaves, would you not like to keep a record of the different types that you have seen? How about taking the impression of the leaves on paper.

Activity 6

Collect different fallen leaves Place a leaf on a notebook with its lower surface (on which the veins are prominent) facing upwards Place a sheet of paper firmly on the leaf and rub over the leaf with a crayon The impression of the leaf will appear on the paper Prepare such prints of different leaves

Modified Leaves

The leaves are also modified as spines or tendrils The spines (Fig 8 6) reduce loss of water and help protect the plant Example· Cactus The tendrils help the plant in climbing (Fig 8.9)
Example pea plant

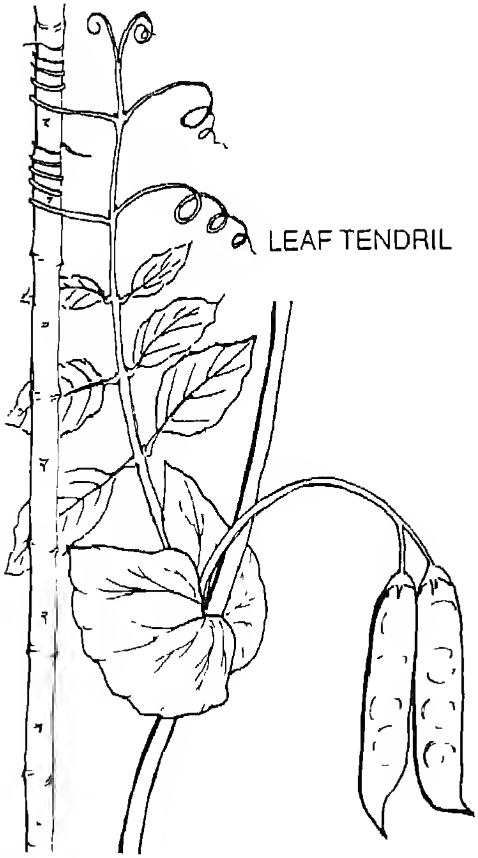


Fig. 8.9 *Leaf tendril*

Flowers and Fruits

How many plants with flowers have you seen? Do you know the names of all these plants? Do all plants have the same kind of flowers? No In fact, we identify many plants by recognizing the flowers first. Do they have the same smell? Flowers smell differently Some flowers do not have any smell Smell the rose, bougainvillaea, jasmine and lily. Do they have the same smell. ?

We know that all flowers do not look alike Why do we like some flowers more than others?

Flowers are of many sizes, shapes and colours. But all flowers have the same basic parts as shown in Fig 8 10.

Activity 7

Bring a flower to school Note the green leaf-like parts in the outermost circle These are called sepals Carefully pick out the coloured petals until you get to the centre of the flower.

Towards the centre of the flower, you may see many little stalks with swollen tops These are called stamens.The swollen tops are called anthers They contain a powdery substance called pollen The stamen is the male part of a flower

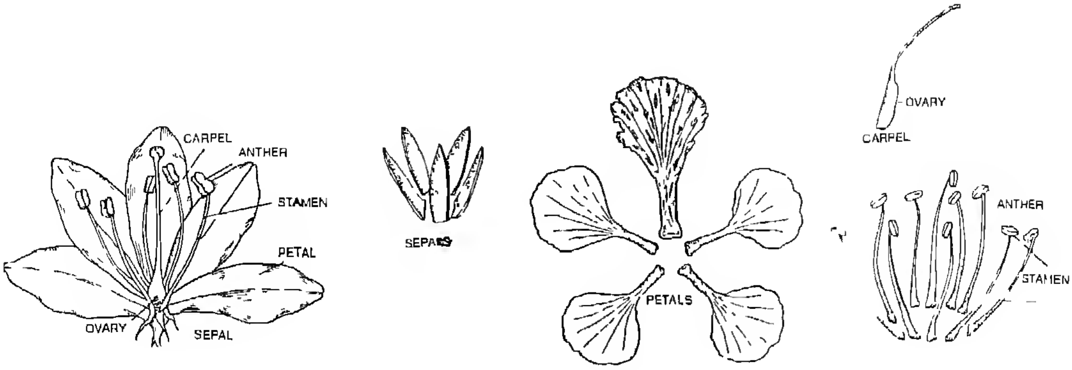


Fig. 8 10 *Parts of a flower*

In the centre of the flower there is a flask-shaped organ, called the carpel The carpel is the female part of a flower The little swollen portion at the base is called the ovary The ovary contains egg-like structures, which are called ovules Pollens are transferred to the carpel (pollination). This is done by insects, wind and water. Eventually the ovules of the flower turn into seeds and the ovary into fruits (Fig 8 11)

Seeds

The corn, peas and beans are seeds The seed contains a baby plant and food for the new plant (Fig 8 12)

ANSWER THESE

1 Which are the two main systems in plants?
2 Why are certain parts of plants modified?

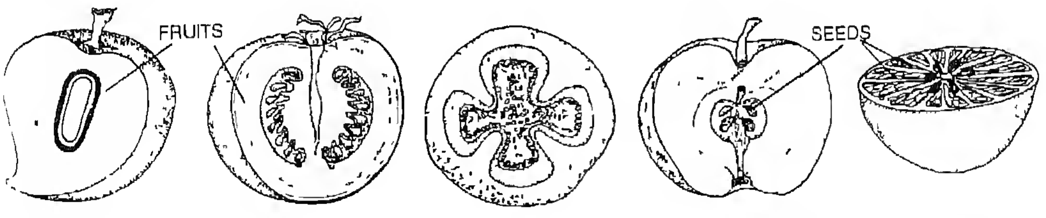


Fig. 8.11 *The fruits*

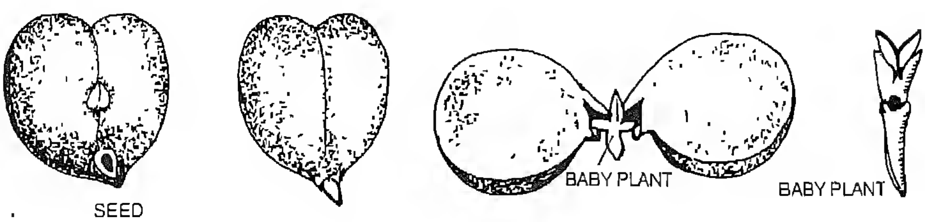


Fig 8.12 *Parts of a seed*

3 Name some modified stems and roots which you eat
4 Why is the stem of cactus thick and green?
5 What is photosynthesis? Why is it essential for plants?

8.2 *Organ Systems in Animals*

All animals, including human beings, have definite organs and systems to carry out various functions Each system has a specific function You should know about the different systems of your own body This may help you maintain your body better

DIGESTIVE SYSTEM

All animals need food to grow and function well The food eaten should be digested properly so that the body remains healthy

When you eat food, it gets broken down into smaller particles Then these particles get changed into absorbable forms in the body This process is called *Digestion* The digested food is absorbed and used in the body The unabsorbed portion is thrown out of the body as faeces There are several organs which are involved in carrying out these processes. These are the mouth, oesophagus, stomach, small intestine, large intestine, anus, liver, gall bladder, pancreas (Fig. 8.13)

Mouth

The mouth contains tongue, teeth and salivary glands Digestion of food starts in the mouth as soon as the saliva mixes with food The saliva is secreted by the salivary glands The mixing of saliva with food takes place when the food is chewed by the teeth

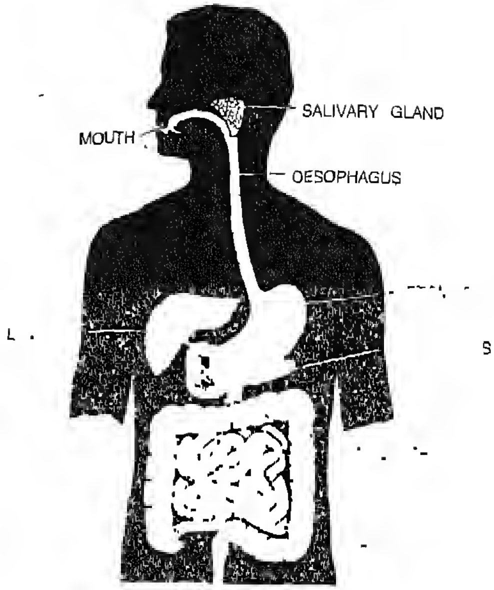


Fig 8 13 *The digestive system*

Activity 8

1 Look into a mirror and count your teeth How many teeth do you have?
2 Look into your friend's mouth and try to count and note various kinds of teeth Are all the teeth in your mouth alike?

In human beings the teeth grow twice—the first time when one is a baby and the second time when one is a child The first set of teeth is called milk teeth. The

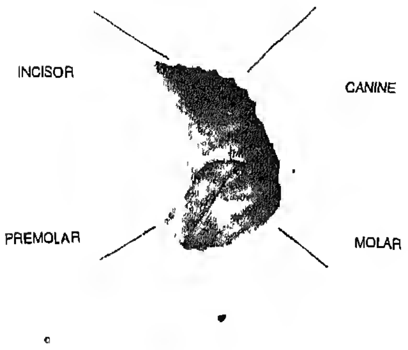


Fig 8.14 *Types of teeth*

second set of teeth is called permanent teeth Most of the adults have 32 teeth. When old people lose their teeth, new ones do not grow to take their place

There are four types of teeth in our mouth—incisors, canines, premolars and molars (Fig 8 14) The incisors are for biting the food, the canines for cutting and tearing the food and the premolars and molars for grinding the food The food is chewed by the teeth

The tongue has many functions It helps in mixing the saliva, swallowing the food and getting the taste. It is also essential for speaking

Activity 9

Make solutions of sugar, aspirin, lemon and salt. Blindfold a friend of yours. Put the above-mentioned solutions one by one on different parts of his tongue Do

Fig. 8.15

all parts of the tongue sense all the tastes? Which parts of the tongue sense these tastes : salty, sweet, bitter and sour See Fig. 8 15 and taste different solutions on these areas of the tongue

Oesophagus

The oesophagus acts as a passage or tube which takes the food from mouth to stomach

Stomach

The stomach is like a bag The food is churned in the stomach and turned into a semi-solid paste The stomach helps digest some kinds of food The food goes to the small intestine from here

Small Intestine

The small intestine is arranged in the form of a coil in our belly. Digestion of food also takes place here The intestine also absorbs the digested food

Large Intestine

It performs the function of absorbing water and helps in removing the undigested solid wastes from the body through the anus

RESPIRATORY SYSTEM

Living organisms need oxygen. Oxygen helps break down the absorbed food in the body to release energy required for our life. The process is known as respiration. Carbon dioxide is formed as a waste during the process

Breathing is an important part of respiration We breathe in air rich in oxygen. When the air reaches the lungs, oxygen enters the blood Carbon dioxide and water vapour from the blood are released into the lungs. These are removed from the lungs with the air we breathe out.

Nostrils, passages in the nose, trachea, bronchi and lungs are the main organs of breathing (Fig 8 16) Together they are known as the *respiratory system* The muscles of the chest and the diaphragm help in breathing in and breathing out

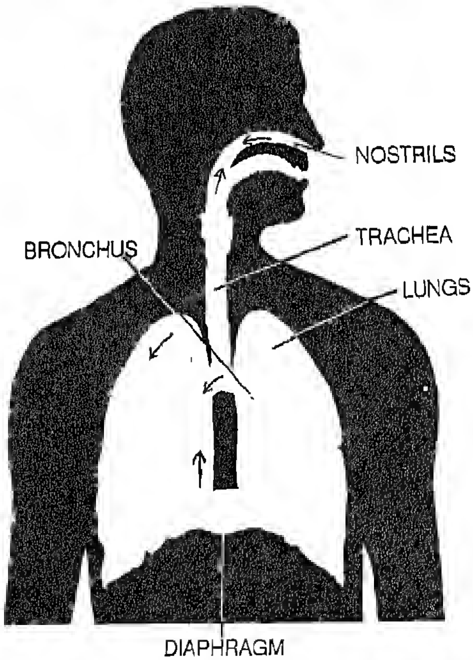


Fig. 8.16 *The respiratory system*

Activity 10

Keep your finger under your nose, close

to the nostrils. Try to feel the air which you breathe out. Does the air come out from both the nostrils with equal force? You would probably be surprised to observe that all of us breathe in and breathe out mostly with one nostril at a time

Trace your finger on the arrow in the diagram. This will help you to follow the path taken by the air in the body.

Have you ever noticed that you have very fine hair in the nose? You have a sticky liquid, too, inside the nose, called mucus. Hair and mucus prevent dirt, dust and germs from entering the respiratory system

As the air passes through the nasal passages, it also becomes warm But if you breathe through the mouth, the air

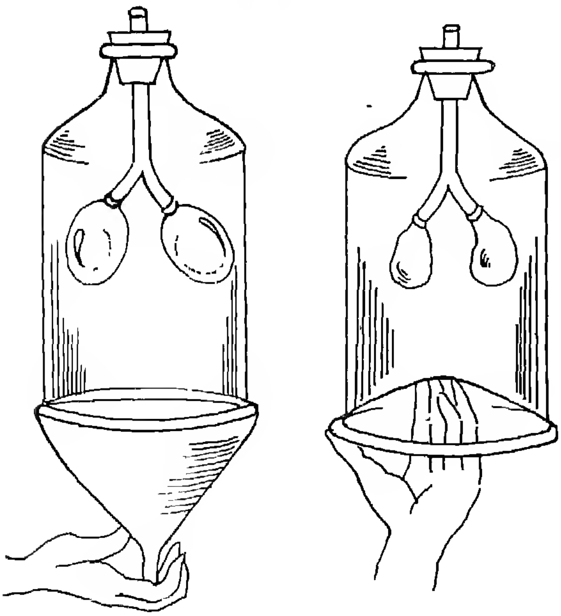


Fig. 8.17

that enters your lungs will not become warm and clean So, always breathe through the nose to prevent germs, dust and dirt from entering your body.

Activity 11

Fix up a glass bottle with a glass tube and balloons as shown in Fig 8 17. The bottom of the bottle should be open. Tie with a piece of string a thin rubber sheet round the bottom

Imagine the bottle as the chest cavity and the balloons as the lungs. Pull the rubber sheet down. The space in the bottle increases and the balloons get inflated When you release the rubber sheet the baloons get back to the normal size.

The action of the rubber sheet shows how the diaphragm works in the body This is the way we inhale and exhale air, with the help of the movement of the diaphragm.

CIRCULATORY SYSTEM

The circulatory system supplies blood to all the organs of the body The heart and the blood vessels are its main organs The blood vessels are of three types—arteries, veins and capillaries (Fig 8 18)

Why is the blood supply to all organs needed? Because the digested food which is absorbed in the small intestine gets into the blood. The blood vessels transport food materials to different

organs of the body. Blood also transports oxygen, carbon dioxide and other materials within the body.

Where is your heart located in the body? It is located in the chest cavity, slightly towards the left

What is the size of your heart? Make a fist of your left palm. The size of the fist is roughly the size of your heart

Activity 12

Observe your hands and legs Also observe the hands and legs of your father or mother. Do you see many greenish blue lines, just below the skin? They are veins Veins are very easily seen Arteries lie a little deeper under the skin so they are not easily seen

Arteries carry blood from the heart to all parts of the body The veins carry blood from all the organs of the body to the heart. A network of capillaries forms the connection between the arteries and the veins

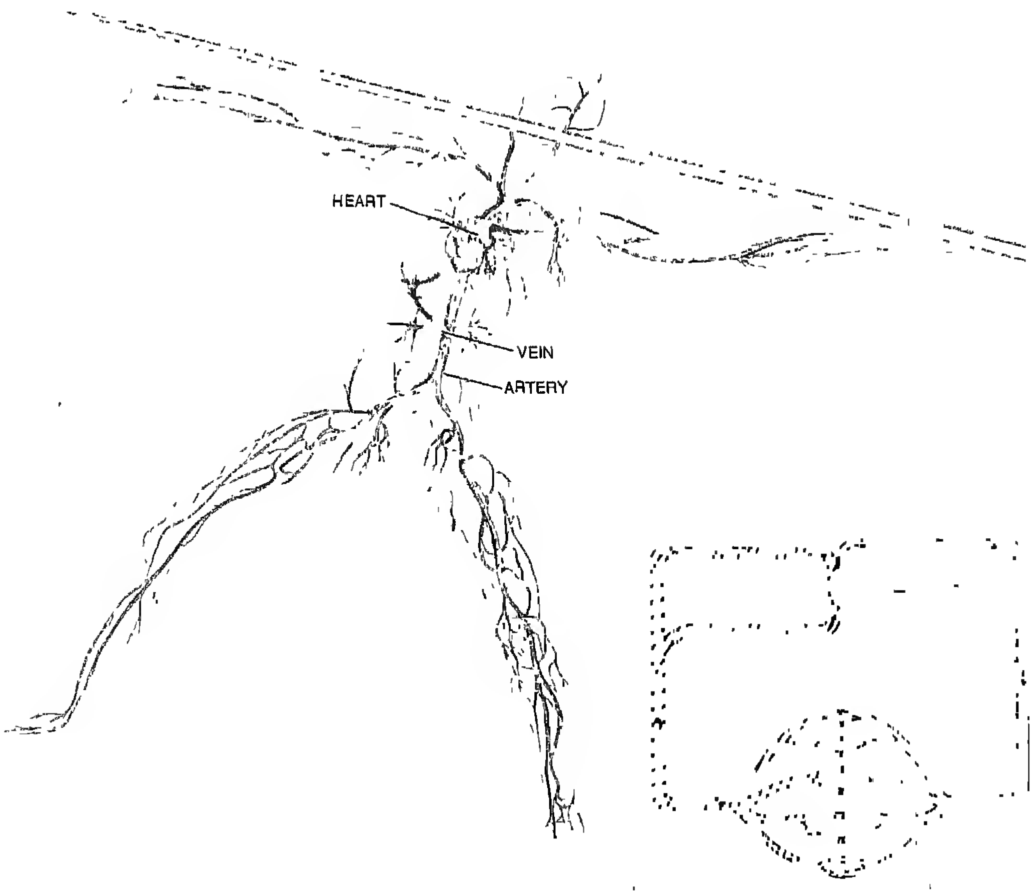


Fig. 8.18 *The circulatory system*

Activity 13

Take a 50 cm long rubber tube and fit it tightly at the end of a glass funnel. Put the open end of the tube in one of your ears. Place the funnel on your chest near the heart

Now try to listen carefully Do you hear a regular thumping sound? These are the heartbeats Count the heartbeats per minute Count the heartbeats after running for a while Compare the two.

> *Do You Know?*
>
> The average heartbeat of an adult human is 70-72 per minute Neil Armstrong was the first human being to land on the moon When he first landed on the surface of the moon, his heartbeats were 156 per minute! More than double the normal heartbeats.

Where and how can you feel the pulse? Have you seen a doctor taking the pulse rate of a patient?

Activity 14

Let us feel our pulse and find out the pulse rate per minute

Place your middle and index fingers on the inner side of your wrist What do you feel?

Do you feel some kind of thumping? This thumping is called pulse Find the pulse rate per minute

Keep your index finger on the temple Do you feel the pulse? Where else on the body can you feel the pulse?

Do you find any similarity between the heartbeat and the pulse rate? Both change according to the condition of the body Doctors can tell whether you are well or not by counting the pulse rate and the heartbeats

THE NERVOUS SYSTEM

Our environment changes continuously Sometimes it is noisy, sometimes quiet It can be dark or light, warm or cool How do we feel the above changes? How do we respond to these changes?

We feel the changes through our senses, such as sight, hearing, smell, taste and touch There are special sense organs sensitive to light (eyes), sound (ears), gaseous chemicals (nose), liquid chemicals (tongue) and heat, cold and touch (skin)

The sensations are carried from the sense organs, through nerves to the brain or spinal cord On receiving a message, the body's reaction to the changes is decided in the brain. The brain then sends out commands to the different parts of the body for action, again through nerves

The brain, the spinal cord and the nerves are the main organs of the nervous system These organs help in coordinating all the functions of the body This system helps the other systems to work together

The brain is located inside the skull The spinal cord runs inside the bony structure of the backbone, while the

nerves are distributed all over the body (Fig 8 19)

Activity 15

Put a blindfold over your eyes. Have someone line up various objects in front of you Touch the objects. Can you identify them? Can you distinguish one from the other?

Can you think of animals which do not have eyes?

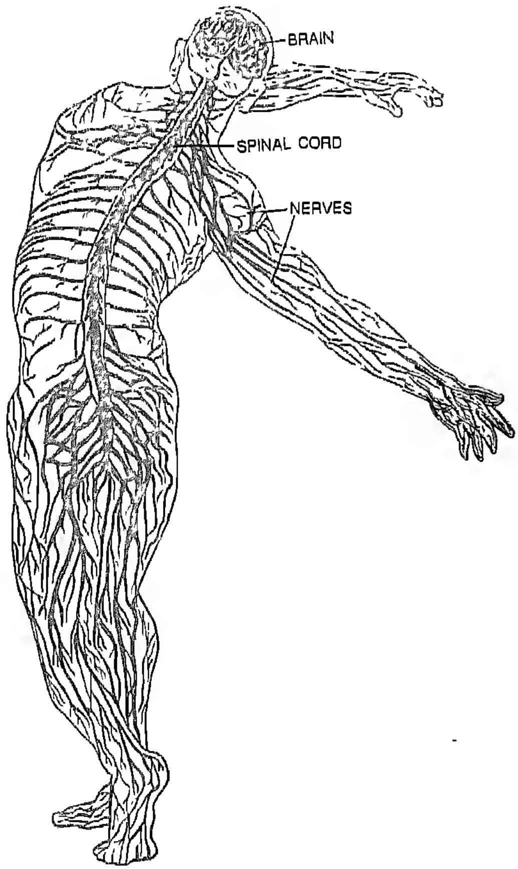


Fig. 8.19 *The nervous system*

The ears are the organs of hearing A part of the ear also helps in sensing the balance of the body

> Can a snake hear? No, the snakes cannot hear at all. They can receive vibrations through their bodies When you walk on the ground, there is thumping and it is felt by the body of the snake When the snake-charmer plays a tune on his *been* (a type of flute), the snake actually does not hear anything But, as the snake-charmer moves the *been* while playing it, the snake sees that and reacts

The tongue is the organ of taste

A part of the inner lining of the nose helps in getting the smell If your nose is blocked due to a cold, your sense of smell is reduced

Sense organs for heat, cold, touch and pain are located in the skin.

THE URINARY SYSTEM

The urinary system collects the liquid wastes and helps the body get rid of them It is made up of two kidneys, two ureters, the bladder and the urethra (Fig. 8 20) The function of the kidneys is to filter the wastes from the blood, producing the yellowish liquid, called urine The ureters convey the urine from the kidney to the bladder Urine is stored in the bladder It is passed out from the body through the urethra.

REPRODUCTIVE SYSTEM

All living organisms have the capacity to

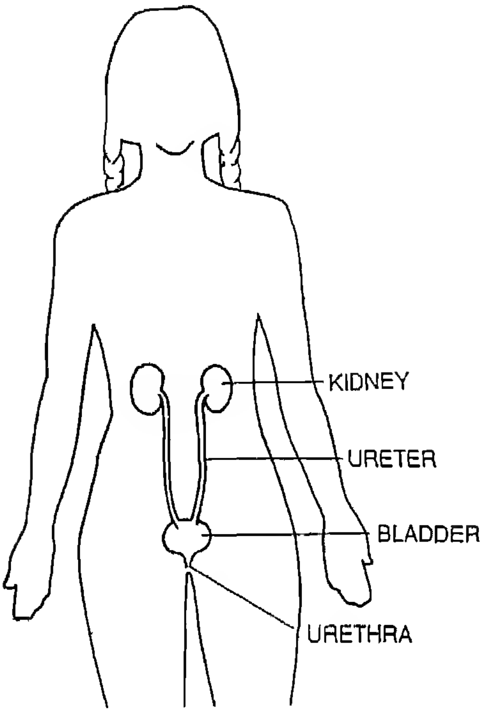


Fig. 8 20 *The urinary system*

produce the young ones which look like them Pigs, crows, cats produce their own kinds Human beings produce human babies. This process of producing individuals of one's own kind, is called reproduction If there is no reproduction all the life on the earth would come to an end Both males and females are required for reproduction Animals (including human beings) have special male and female systems for reproduction

OTHER SYSTEMS

There are several other systems which perform major functions The muscular system helps in movement and locomotion The movement of the internal organs like the heart, the lungs and the digestive system is all due to muscles

The skin helps in protection of the body It also has sense organs and sweat glands

The skeletal system consists of the skull, the backbone, ribs and limb bones. The skeleton protects the inner body parts It also helps in movement and in making the body rigid.

DIFFERENT ORGANS FOR LOCOMOTION

You have studied earlier that all animals move Animals move for two main reasons to obtain food and to protect themselves

Animals have special organs to move from one place to another Birds have wings to fly Human beings have legs for locomotion

LOSS OF A PART AFFECTS FUNCTIONING

Activity 16

(i) Try to hold a pencil in your hand without using the thumb Write a few words without using the thumb. Do you find it difficult to write? Yes

(ii) Take two pencils Hold a pencil each in your hands Stretch your hands Now close on and try to bring you

that the tips of the two pencils meet

(iii) Uproot a plant and cut its roots Fix the plant in the soil and water it. What do you observe?

Did you find it difficult to perform activities without using a certain part of the body? You can imagine how much the function of the body would be affected by the loss or absence of a part

Answer These

1 How many types of teeth do we have?
2 Why is it not advisable to breathe through the mouth?
3 Which part of your body is responsible for balancing the body?
4 What are the main organs of the urinary system of your body?

YOU NOW KNOW

— Living organisms—plants and animals—have definite parts which differ in shape, size, and functions

— Plants have definite parts that perform definite functions. Roots, stem, leaves, flowers and fruits are some of the important parts of a plant. The parts of a plant are sometimes modified to perform additional functions

— Animals have various external and internal organs to perform different functions—respiration, digestion, circulation of blood, excretion, reproduction, locomotion and coordination.

Now Answer These

1 Say whether the following statements are true or false

(i) Roots absorb minerals and water from the soil.
(ii) The wheat plant has fibrous root system
(iii) Supporting roots are found in all plants
(iv) The stems of all plants can stand erect
(v) Leaves manufacture food for the plants
(vi) Leaves can manufacture their food without sunlight.
(vii) Seeds store food in them
(viii) The mouth cavity contains salivary glands and teeth only
(ix) The stomach is like a bag in which food is churned into semi-solid paste
(x) We should always breathe through the nostrils.
(xi) In human body the heart is located on the right side of the chest cavity
(xii) Animals can manufacture food
(xiii) The brain is an organ of the nervous system

2 Fill in the blanks

(i) Onion is a modified ______

(ii) Cactus-spines are modified ______

(iii) The vegetables such as carrot, beetroot and radish that you eat are modified ______

(iv) Roots provide support to plants and also absorb ______ and ______

(v) Leaves are green because they have ______

(vi) Plants manufacture food by the process of ______

(vii) Ovules grow into ______ and ovaries are transformed into fruits

(viii) From the heart the blood is transported to all the organs of the body by ______

(ix) You have ______ types of teeth

(x) You have ______ for biting food

(xi) Canines are for ______ and ______ food

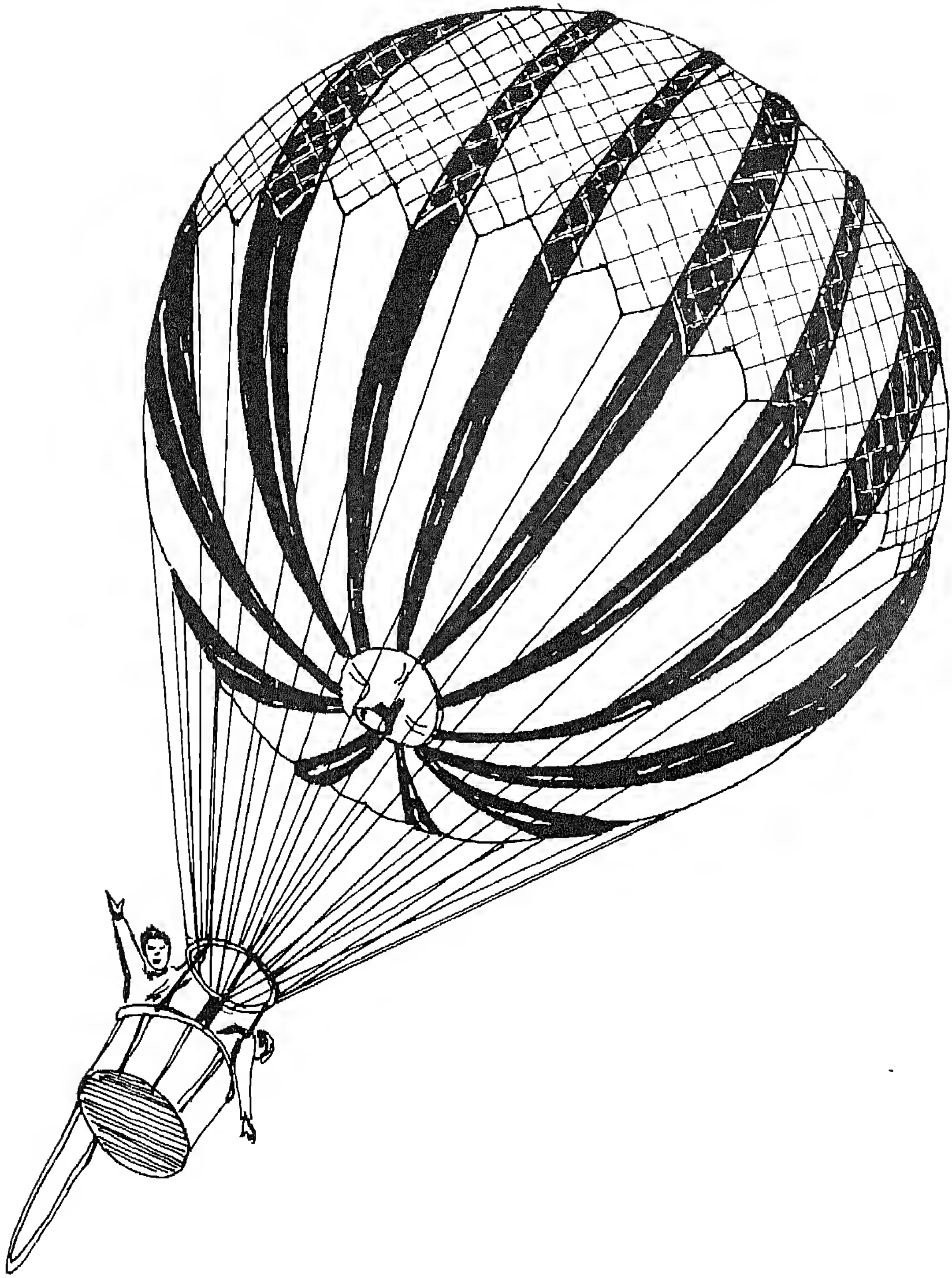
(xii) Premolars and ______ are for grinding food

(xiii) ______ are replaced by the permanent teeth

3 What are the organs of respiration in man?

4. Name the organs of the urinary system

5 How would you distinguish between ice and ice-cream with your eyes closed.



Air

AIR IS EVERYWHERE around us No living thing can survive without air Is air made up of only one kind of matter? In this unit, you will learn about various *components of air* You will also learn the importance of these components and their uses.

9.1 *Air is All Around*

Air is all around You cannot see it You cannot smell it. But it is there all the same on the ground, on the tree-tops, and high up in the sky where the aeroplanes fly Air is inside you as well as around you

The air covers the whole earth This cover of air is called *atmosphere*. You live within the atmosphere The atmosphere extends over hundreds of kilometres. Up to a height of 16 kilometres, you find clouds, rain and snow As you go up in the atmosphere, there is less and less air The jet planes usually fly above the clouds.

You have already learnt that air is matter Air occupies space and has mass It has no colour and you can see through it It fills all the space available to it.

Look at Fig. 9 1. Is there anything in the box?

Activity 1

Fill a plastic bucket half with water

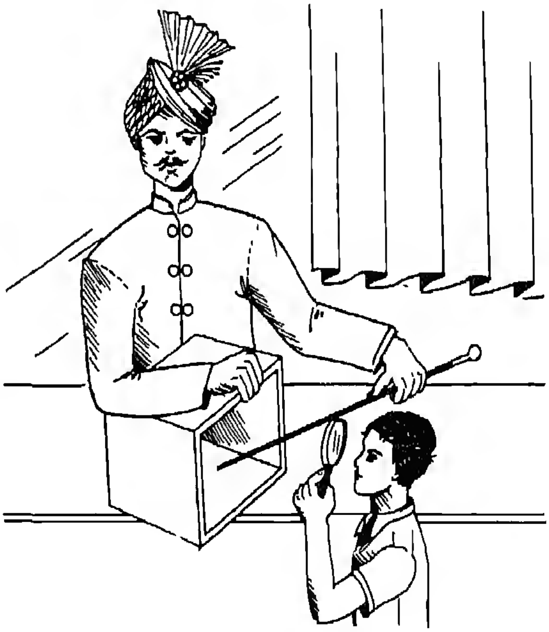


Fig. 9.1 *Is there* *Wrong,*

Introduce an in the water. Ob water enter the

Water does because the bott

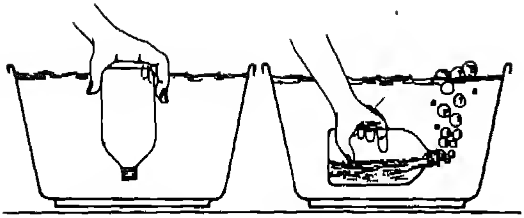


Fig. 9.2

tilt the bottle slightly What do you find? You will find bubbles of air escaping through water (Fig 9 2). This shows that air occupies space

Air is a gaseous substance It can be compressed You compress air when you fill a bicycle tube or football with air (Fig 9 3)

ANSWER THESE

1. The cover of air around the earth is called ______________
2. Air occupies ________ and has ___
3. How will you show that an empty glass bottle is filled with air?

9.2 *Air is a Mixture*

Air is a mixture of gases. Until the eighteenth century, people thought that air was just one substance Experiments have proved that it is really not one substance but a mixture of several gases. Nearly four-fifths of the air is *nitrogen.* About one-fifth of the air is *oxygen.* The air has also a small amount of carbon dioxide, argon, helium, water vapour and dust particles (Fig 9.4)

Activity 2

Take a glass tumbler Fill it about half with water Add a few pieces of ice Observe the outside surface of the

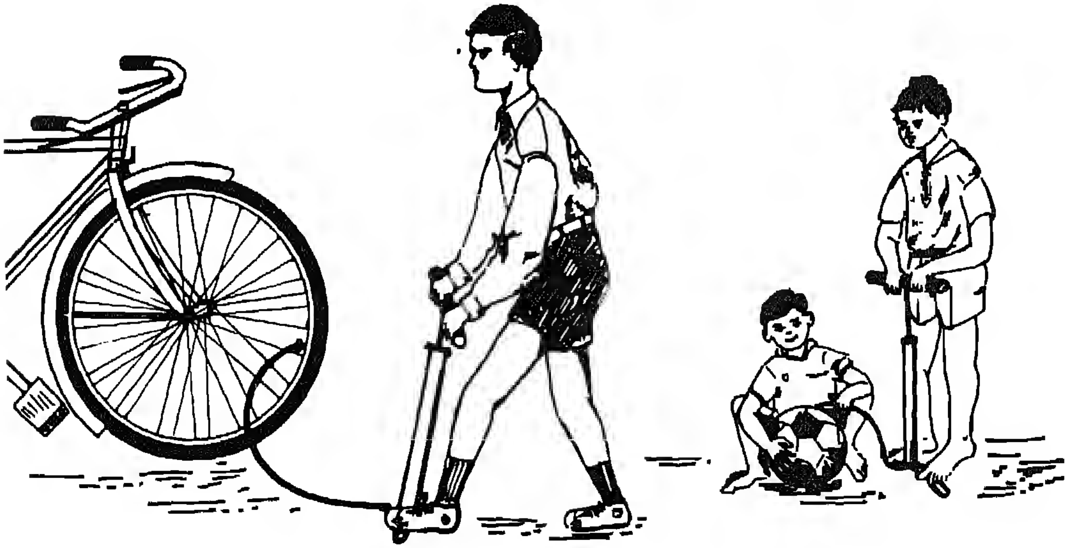


Fig. 9.3

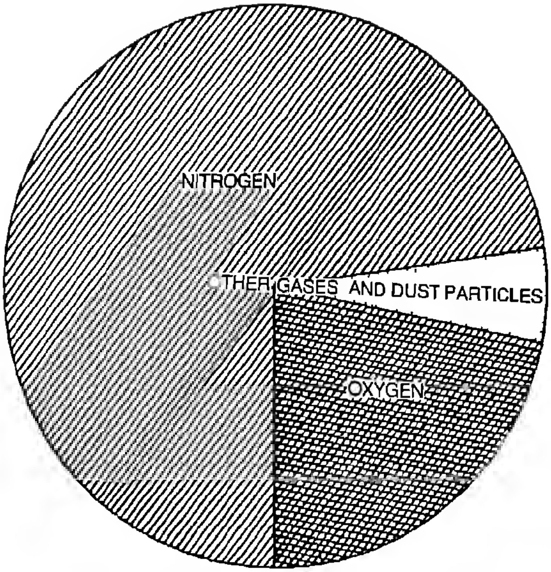


Fig. 9.4 *Composition of air*

tumbler You will find tiny drops of water. The water vapour present in air condenses and forms these tiny drops of water.

Have you ever thought where the water vapour comes from into the air? It has come from the water which has evaporated from the surface of the earth.

Have you seen dust particles moving in a beam of light in a dark room? (Fig 9 5) Where do these dust particles come from?

Activity 3

Take two teaspoonfuls of lime (calcium hydroxide) in a glass tumbler Fill the glass tumbler about two-thirds with water. Stir with a spoon or a small wooden stick. Allow the contents of the tumbler to settle. Decant some clear liquid to another glass tumbler. This clear solution is called *lime water.*

Take about half of this lime water in another glass tumbler Blow air into one tumbler with a bicycle pump. Blow some air from your mouth into the other tumbler by using a straw or rubber tube. Observe both the glass tumblers In which tumbler does the lime water turn milky faster? You will find that the one into which exhaled air was blown, turns milky faster

This shows that exhaled air contains more carbon dioxide than ordinary air.

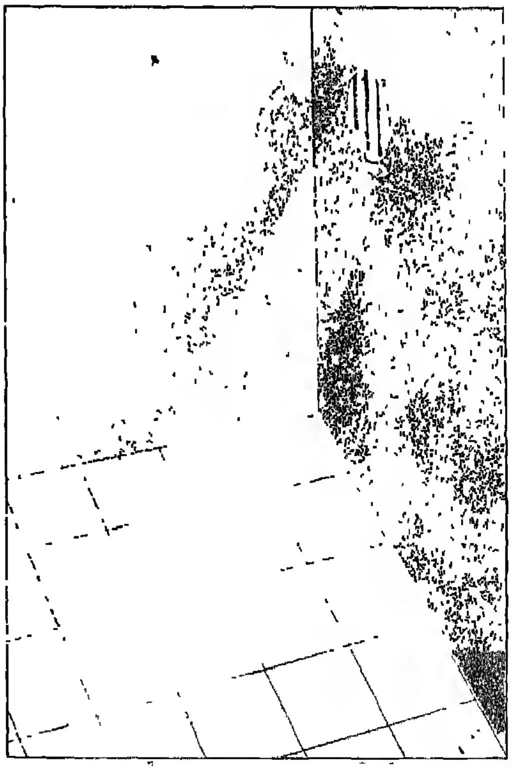


Fig. 9.5

A small quantity of carbon dioxide is present in the air Carbon dioxide is formed when a fuel burns and animals breathe.

When you burn a candle, paper, kerosene, coal, firewood or cooking gas, oxygen is necessary

Activity 4

Take a glass or plastic trough. Fill it about one-third with water Dissolve one teaspoonful of caustic soda (sodium hydroxide) in water Add a few drops of ink Now fix a candle on a metallic or stone block Put the block in the water Light the candle Cover the lighted candle with a large glass bottle with a wide mouth or a gas jar (Fig 9.6). Observe it carefully

You will see that within a short time the candle stops burning. The coloured water rises up in the bottle Why does the candle stop burning? Why does the water rise up in the bottle? This is because the component of air (oxygen) present in the bottle, which supports burning, is used up In its place carbon dioxide is formed. The carbon dioxide is absorbed by the caustic soda solution and this forms a vacuum Water rises up in the bottle to fill this vacuum A major component of air which does not support burning and is still present in the bottle, is nitrogen

The candle continues burning if it is not covered with a glass bottle (Fig. 9 7). This is because the oxygen of air is continuously available to the candle for burning.

The major part of air which is not used up by a burning candle is called nitrogen It takes up a four-fifth (78 %) of the space that air fills Nitrogen is important for living things All living things need nitrogen compounds for their growth.

ANSWER THESE

1. Air is a ___________ gases
2. The major components of air are ___________ and ___________
3. How will you show that air contains water vapour?

9.3 *Air is Necessary for Living*

You have already learnt that air is

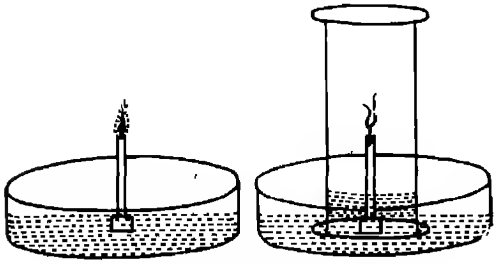


Fig. 9.6 *Oxygen supports burning*

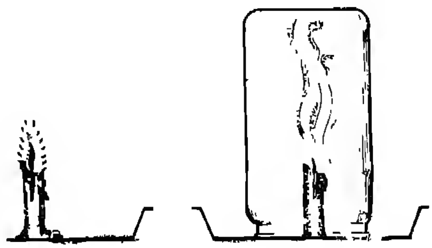


Fig. 9.7

required for breathing by all living organisms. At higher altitudes, air is thin and breathing becomes difficult. Mountaineers carry with them cylinders containing oxygen. Divers also carry oxygen cylinders when they go deep into the sea because there is no air Oxygen is also supplied to the patients who suffer from breathing difficulties (Fig 9 8)

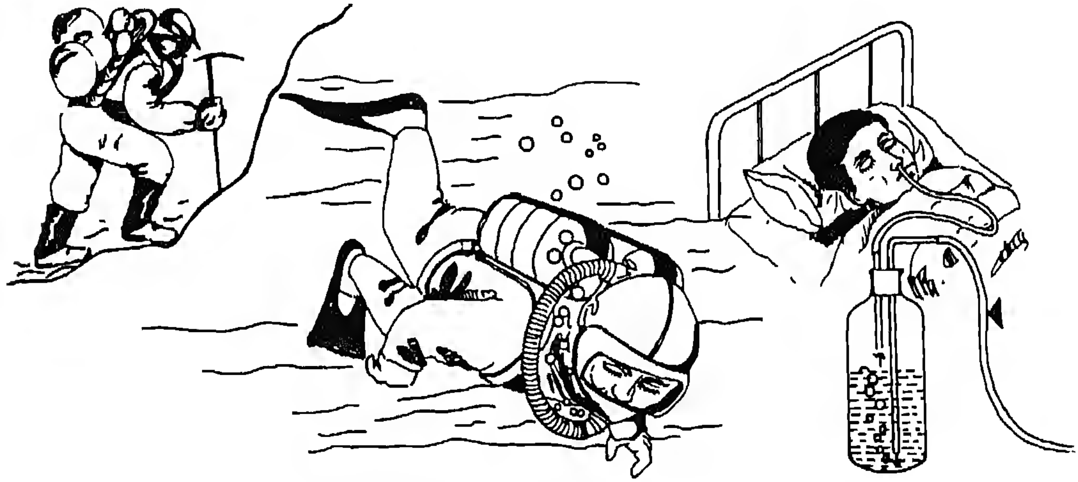


Fig. 9.8 *Oxygen is required for breathing*

Activity 5

Take a small glass jar. Put a cup of water and some food in it. Catch some insects from your locality. Place three or four insects in the jar. Close the jar tightly. Observe for a few days You will find that the insects become *inactive* and *finally* die. Why do they die? This is because the oxygen present in the closed jar is used up by the breathing of the insects.

Like animals, plants also use oxygen for respiration You might wonder how fish and many other organisms live in water. Where do these organisms get oxygen for respiration from?

Activity 6

Take some water in a small vessel, and put it on a tripod. Heat the vessel slowly. Observe the water in the vessel. You will find tiny bubbles sticking to the walls of the vessel. These bubbles are of air (mainly oxygen), which is dissolved in water Now boil the water for a few minutes to remove all dissolved air. Cover the vessel and allow the water to cool. When the water is cool, put a small fish in it quickly and cover immediately. Observe for some time. You will see that the fish becomes restless and then dies. This shows that aquatic animals cannot survive without the air dissolved in water.

Oxygen is used by living organisms for respiration During respiration oxygen breaks down the food to give energy. During this process carbon dioxide and water vapour are produced and given out. Carbon dioxide along with water is used by the green plants in the presence of sunlight to make their food This process is called *photosynthesis* During this process oxygen is given out In nature the balance of oxygen and carbon dioxide is thus maintained (Fig 9 9)

ANSWER THESE

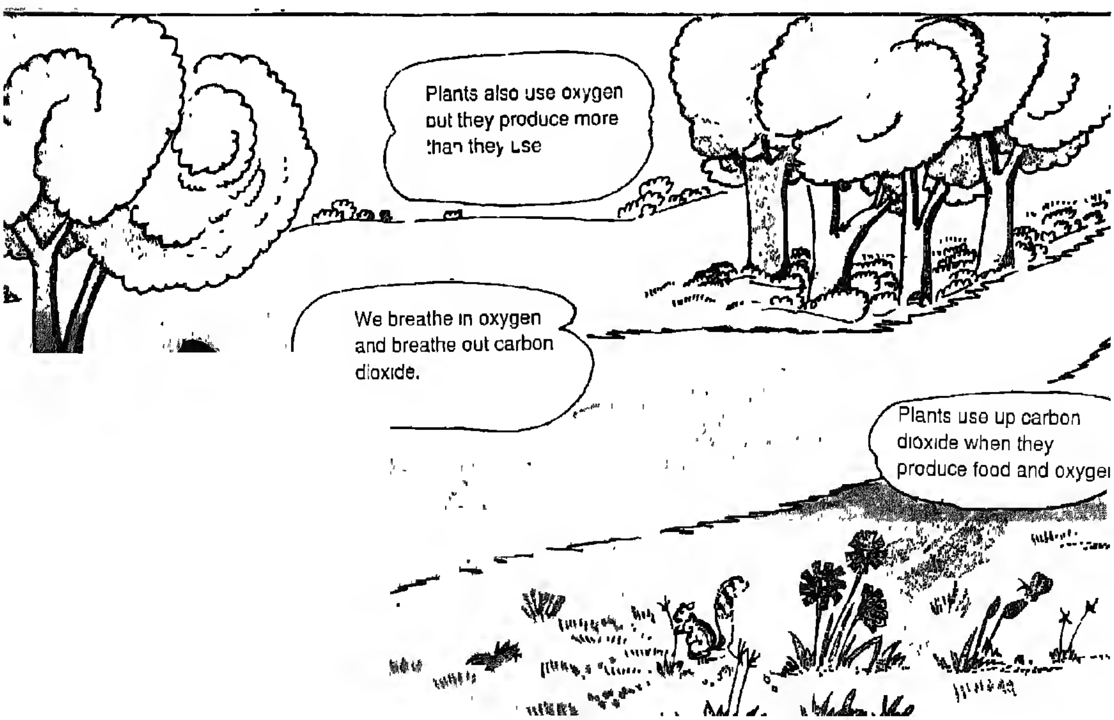
1. What is photosynthesis?
2. Animals in water use _________ dissolved in water
3. Plants and animals maintain the balance of _________ in air
4. Oxygen _________ the food which you eat

9.4 *Air is Useful to Human Beings*

(i) Air is required by human beings for respiration.

(ii) Fire is used by man for various purposes. Man burns many things to produce fire Air is necessary for burning things. Observe a *chulha*, *sigri* or kerosene stove (Fig 9 10) and find out how air is made available for burning. You will see that in firewood *chulha*, there are gaps between the pieces of firewood. These gaps make air

Fig 9.9 *Balance of gases in nature*



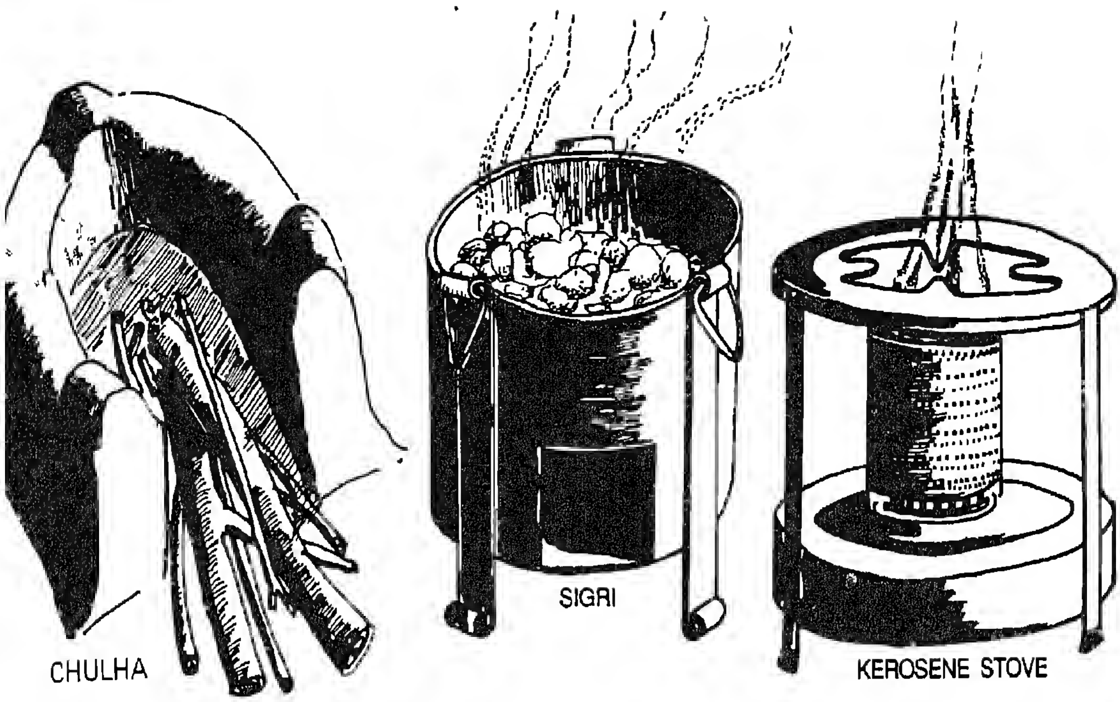


Fig. 9.10

available all around In a *sigri,* metal bars support coal and also allow air to come in In a wick stove, there is a special arrangement of *perforated* cylinder for air to come in Burning cannot continue without a continuous supply of air

After a fuel is burnt, smoke is formed. The smoke rises up. The air spreads the smoke to a larger area The smoke is harmful. Thus, the effect of smoke is decreased In a good *chulha* a chimney takes the smoke out of the kitchen. In cities, factories have tall chimneys. These chimneys take smoke to a height. Air spreads it all over. Without the chimney, the health of both the workers and the people living in the neighbourhood would be affected

(iii) Vehicles such as bicycles, some kinds of carts, scooters, cars, trucks and aeroplanes have tyres filled with compressed air. Such tyres make transport smooth and easier

(iv) You play with balloons and balls These can be used only when they are inflated with air

(v) Compressed air is used in

machines for digging, mining and breaking stones. Compressed air is also used for lifting liquid substances from a mine.

(vi) Compressed air is used in the brake-system for stopping trains.

(vii) Air helps in drying agricultural products such as grains, pulses, dry fruits, and also wet clothes Evaporation of water takes place when the things are being dried. The drying of clothes is faster if more surface is exposed to air Things dry faster in the wind.

(viii) People feel cool in summer under a fan The fan circulates air This helps in rapid evaporation of the sweat. You feel cool when sweat evaporates from the body.

(ix) You have already learnt that during winnowing the moving air helps in separating the husk from the grains.

(x) Air helps in the movement of sail-boats, gliders, parachutes, and air-craft Birds, bats, and insects fly in air

(xi) Air makes the wind mill move (Fig. 9 11). The wind mill is used to draw water from tube-wells and to run flour mills Along the coast wind mills are used to generate electricity

(xii) Air helps in the dispersal of seeds and pollination of flowers

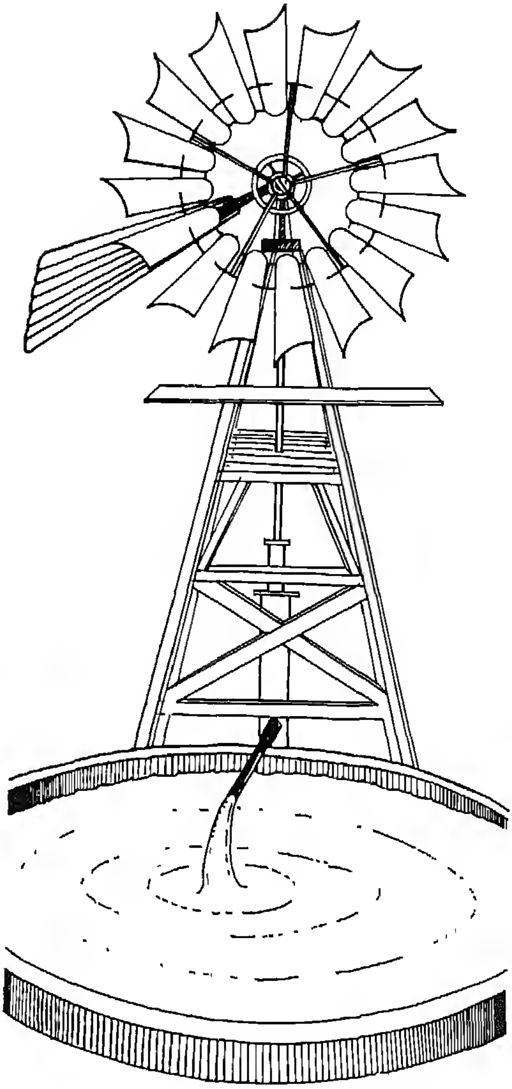


Fig. 9.11 *Wind mill*

ANSWER THESE

Mention five uses of air.

2 How will you show that air is needed for burning?

3 How does air reduce the harmful effects of smoke?

YOU NOW KNOW

— The cover of air over the earth is called atmosphere
— Air occupies space and has mass.
— Air is a mixture containing nitrogen, oxygen, carbon dioxide, water vapour and dust particles.
— Oxygen supports combustion and life.
— Carbon dioxide is needed by green plants to make their food.
— Aquatic organisms breathe the air dissolved in water
— All living organisms breathe air to remain alive.
— Air is useful to man in many ways. It is used for inflating tyres, balloons, and footballs and for drying, winnowing, etc
— Various harmful gases spread in air

NOW ANSWER THESE

1 How will you show that air is matter?
2 How will you show the presence of carbon dioxide in air?
3 The supporter of combustion in air is ____________
4. ________ forms the earth's atmosphere
5. Aquatic organisms use ________ dissolved in water
6 Green plants need ________ to prepare their food
7 What makes air impure?
8 Mention three objects which are inflated by air and are used commonly
9 When you finish your work in a laboratory, you put the lid back on the spirit lamp What happens then? Why?
10 Why do mountaineers and divers carry oxygen cylinders with them?
11 Plants use carbon dioxide for making their food. Where does this carbon dioxide come from in the atmosphere?
12 How will you show that air is present in a lump of soil?
13 When you set fire to a piece of paper, it burns well. But when you set fire to a crumpled ball of paper, it burns only at the edges Why is it so?
14. Suppose the green plants do not take in carbon dioxide and give out oxygen What would happen?

UNIT TEN

Water

WATER IS THE MOST COMMON and important substance around us. We use water every day for bathing, washing, drinking, and several other purposes Water is used in agriculture and industries It is important for all living beings If water is not available to plants, animals and human beings, they will die Water has certain properties which make it so important In this unit you will learn many things about water

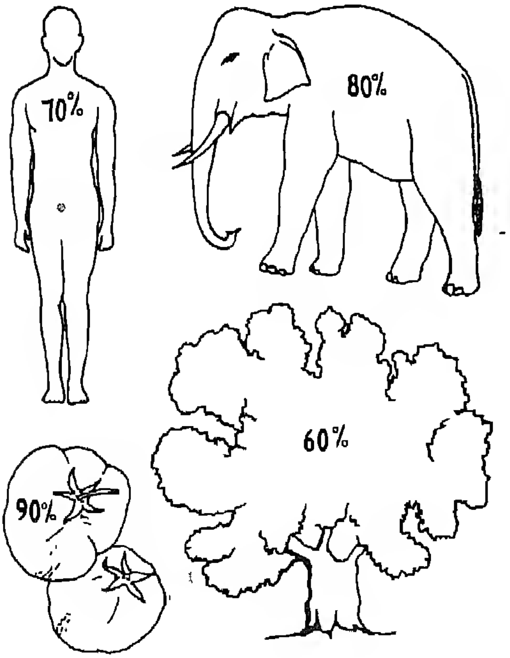


Fig. 10.1

10.1 *Water is Essential for Life*

Water is an essential component of all living bodies All animals and plants contain large amounts of water All animals and plants need water Human beings cannot live without water. The human body has about 70 per cent water by weight Figure 10.1 shows the amount of water present in some animals and plants

Animals drink water from ponds, streams and rivers. Plants take in water from the soil through their roots From the roots water goes to different parts of the plant. The plant uses this water for its life processes. It also loses water continuously from the tiny openings in the leaves This process is called *transpiration.*

Water helps animals keep cool Seeds cannot germinate without water

Activity 1

Soak some quantity of gram in water for

a few hours Remove the gram from the water Keep it in a wet cloth Wet the cloth everyday for a few days What do you observe? You see that the gram begins to germinate whereas dry gram does not germinate

Activity 2

Put some wheat flour in a dish. Mix it with water Keep it for two or three days in wet condition. What do you notice? It starts giving a foul smell You may find that a layer of mould has grown over it How does it happen? The spores (seeds) of the mould, a type of plant, are present in air. They cannot be seen with the naked eye These spores settle down on the wet flour and grow because they get water and food.

Thus you see that water is essential for germination and growth of plants.

For a cabbage seed to grow into a cabbage, about 25 litres of water is required. For growing 1 kg of wheat about 1,500 litres of water is required For growing 1 kg of rice about 4,500 litres of water is required.

Most of the life processes in plants and animals occur in the medium of water In addition, human beings also need water for various other purposes They need water for bathing, washing, cleaning vessels, flushing the toilet and for other activities

A villager in India uses about 12 litres of water every day In cities, a person uses 50 to 2000 litres of water every day. As the living standard improves, the requirement of water also increases You have already learnt that the water requirement of plants is quite high. Water is required for irrigation in the fields. Largest amount of water is consumed in agriculture Water is used to generate electricity.

Water turns the water wheels which are used to run flour mills (Fig. 10.2) Many industries, such as paper, rayon, petroleum refining, fertilizer, dye, drug and chemical industries, require large quantities of water. Other industries also need water

In some countries people use water to warm their houses. Water is used to keep things cool A car radiator is filled with water to keep the engine cool

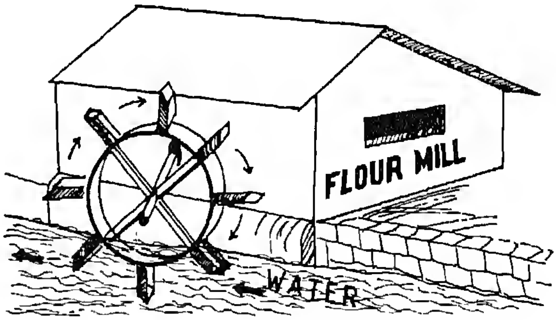


Fig 10.2 *Water mill*

ANSWER THESE

1 Fill in the blanks:

(i) Water is one of the basic constituents of all ______ things

(ii) Water is required in the home for ________ and ______

2 What is transpiration?
3 How will you show that water is essential for the germination of seeds?

10.2 *Sources of Water*

The largest amount of water on the earth is in oceans The oceans cover more than two-third surface of the earth. The sea water is salty and cannot be used at home and in agriculture

The other sources of water are springs, rivers, lakes, ponds, wells, rain and snow Besides, water can also be obtained from underground sources

Water obtained from these sources is not always fit for drinking and cooking purposes Many impurities and germs may be present in it Various methods are used to make it fit for drinking

People in cities get water from taps The water has to travel a long way to reach the taps In many cases, water is first pumped from a source, such as a river or a lake, and collected in a reservoir The water then goes to the water-works where it is made clean. Here the water is allowed to filter through layers of gravel and sand The dirt stays behind in the sand Then water is treated with some chemicals like chlorine to kill the germs The clean water is supplied through main pipes to different parts of the city Smaller pipes take the water to each house (Fig 10 3).

In places where the tap water is not available, people draw water from rivers, lakes, springs and wells The water from these sources should be made fit for use by boiling, filtering and treating it with some chemicals such as potassium permanganate

Pure water is colourless, odourless, tasteless and transparent Water from most sources available to us is not pure. It contains small quantities of dissolved salts and gases. These dissolved substances give a taste to water Water from wells, tube-wells and taps have dissolved substances Even the rain water is not pure, though it is fit for drinking Water becomes unfit for drinking if some harmful substances are present in it Sometimes some suspended materials may be present in water These may be removed by filtration.

The water which contains large amounts of dissolved salts is called *saline*

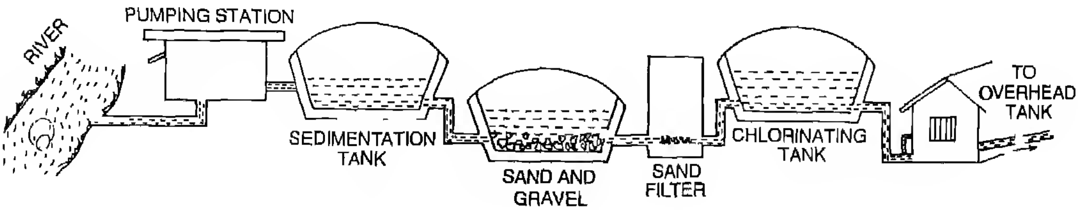


Fig. 10.3 *Supply of drinking-water*

water. You can easily tell whether water is saline or not just by tasting it Sea water is saline Rain water is not saline. Water from other sources may also be saline in some cases

ANSWER THESE

1. Mention three sources of water
2. Which is the largest source of water on the earth?
3. What chemicals would you use to kill the germs present in water?
4. What are the different methods to make water fit for use?

10.3 *Physical Properties of Water*

You have already learnt that water exists in three states—solid, liquid and gaseous You know that pure water is colourless, odourless, tasteless and transparent These are some of its physical properties

Water normally exists as a liquid at room temperature When water is cooled, it changes into ice When water is boiled, it changes into steam.

Activity 3

Take a glass or plastic funnel Put small pieces of ice into it. Insert a laboratory thermometer (—10°to 110°C) into the ice (Fig. 10 4) Measure the temperature of the ice When the ice melts into water, it drips from the funnel Do you notice any change in the temperature?

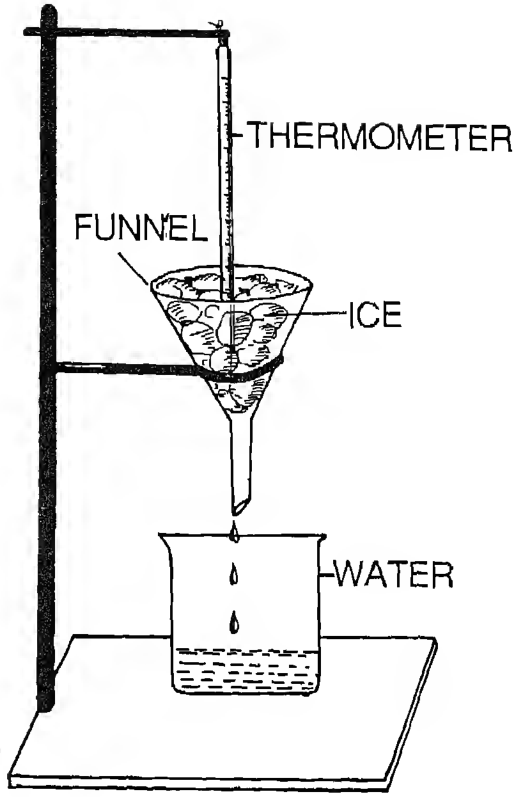


Fig. 10.4 *Melting of ice*

Note the temperature You will find that the temperature of the melting ice does not change It melts at 0°C This temperature is called the *melting-point* of ice. On the other hand, if water is allowed to cool, it changes into ice at 0°C

Activity 4

Fix a boiling-tube to the stand as shown in Fig. 10.5 Fill it about one-third with water. Insert a thermometer (—10°to 110°C) in such a way that its bulb is just above the water. Heat the boiling-tube

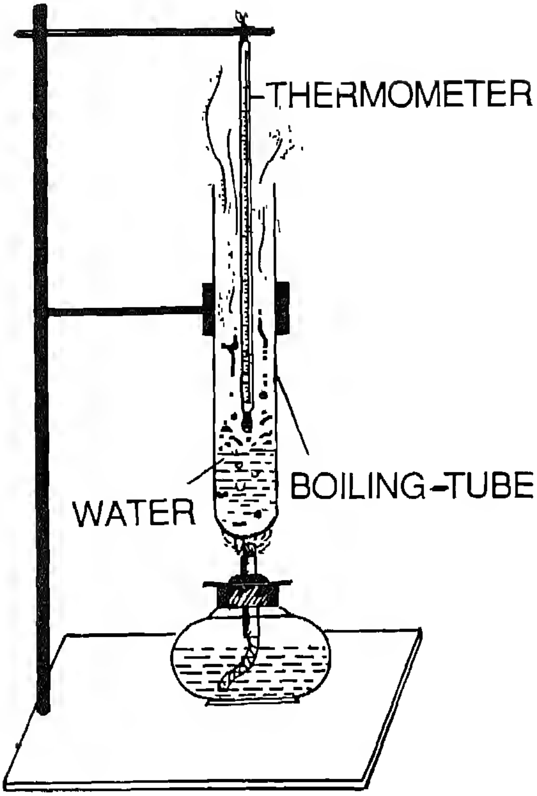


Fig. 10.5 *Boiling of water*

with a spirit lamp When the water starts boiling, note the temperature. You will find that the temperature does not change once water starts boiling This temperature is called the *boiling-point* of water. It is 100°C. At this temperature water changes into steam.

WATER DISSOLVES MANY SUBSTANCES

Activity 5

Fill a test-tube about half with water. Add a teaspoonful of common salt Shake it gently for about a minute. What do you observe? You will find that the salt disappears It means it has dissolved in water

Keep on dissolving more and more salt in the water Continue to add more and more salt until no more salt dissolves. You may be surprised to find the amount of salt that can be dissolved in such a small quantity of water

If you heat the test-tube, more salt can be dissolved Repeat the activity with sugar and washing-soda Large amounts of these materials also can be dissolved in water As before, you will find that at higher temperatures, more quantities of these substances can be dissolved

Try to dissolve in water as many substances as you can. Make a list of those substances which dissolve in water

Thus you will find that water dissolves many substances. The quantity of a substance which dissolves in water increases with temperature Similarly, water dissolves liquids like alcohol Water dissolves gases like oxygen which is essential for aquatic life, that is for animals living in water.

In our body water dissolves minerals, gases and body-chemicals and carries them around where needed. It also carries the wastes and removes them from the body.

This property of water of dissolving many substances makes it very useful in industries and in daily use This property

also makes water so useful to living organisms.

ANSWER THESE

1 State three physical properties of water.
2 How will you determine the melting-point of ice?
3. Mention the three states in which water exists
4 What will happen, if you mix oil with water ?

10.4 *Water Cycle in Nature*

You have already learnt that on heating water turns into water vapour. Water vapour on cooling forms water again The change of water from one form to another over and over again makes the *water cycle* in nature

Activity 6

To understand the water cycle in nature try to set up a small water cycle

Take some amount of water in an aluminium kettle Heat the kettle till the water starts boiling You will see water vapours coming out of the spout. Bring a ›etal plate near the spout (Fig. 10 6). hat do you observe? You will find ıter drops falling from the plate. This ,hows evaporation and condensation of water on a small scale A similar process takes place in nature on a large scale

The sun warms the water in oceans,

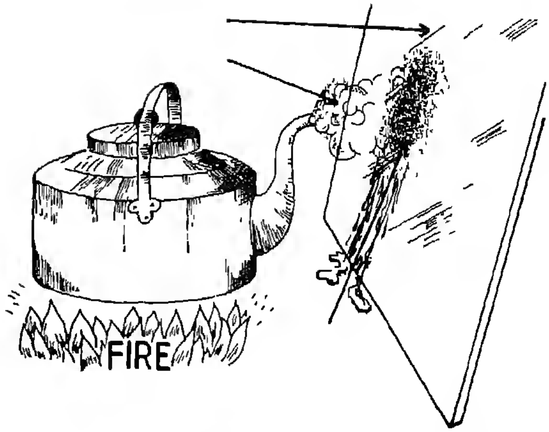


Fig 10.6 *Condensation of water vapour on a metal plate*

ponds, lakes and rivers The water from these sources evaporates into the air continuously The heat of the sun warms up the air near the surface of the earth This warm air containing water vapour rises up In the atmosphere temperature goes down with height When the water vapour cools at higher altitudes, minute water droplets are formed. These water droplets form clouds. When these water droplets in the clouds come together, they form drops of water These drops of water may fall as rain. If air cools to a greater extent, the water droplets freeze into snow particles. These particles combine to form snow flakes which fall as snow in colder regions Can you make cloud?

It is easy. Simply breathe out on a cold day through your mouth What do you observe? You will see water vapours coming out in the form of mini-cloud. Now breathe out on a mirror (Fig 10.7). You will find some water droplets on the

Fig 10 7 *Formation of mini cloud*

mirror This is how rain is formed from the clouds

At some places during winter the snow falls. When the snow melts, water flows into streams and rivers. Many of these rivers fall into the ocean Most of the water falling in the form of rain also reaches the sea through streams and rivers.

A part of the rain water evaporates. A part of the rain water is absorbed by the soil and goes underground The water on land is utilized by living things, including human beings, which also comes back to nature through various life processes The water cycle occurs in nature all the time (Fig. 10 8) It makes water available in the form of rain It plays an important role in regulating weather

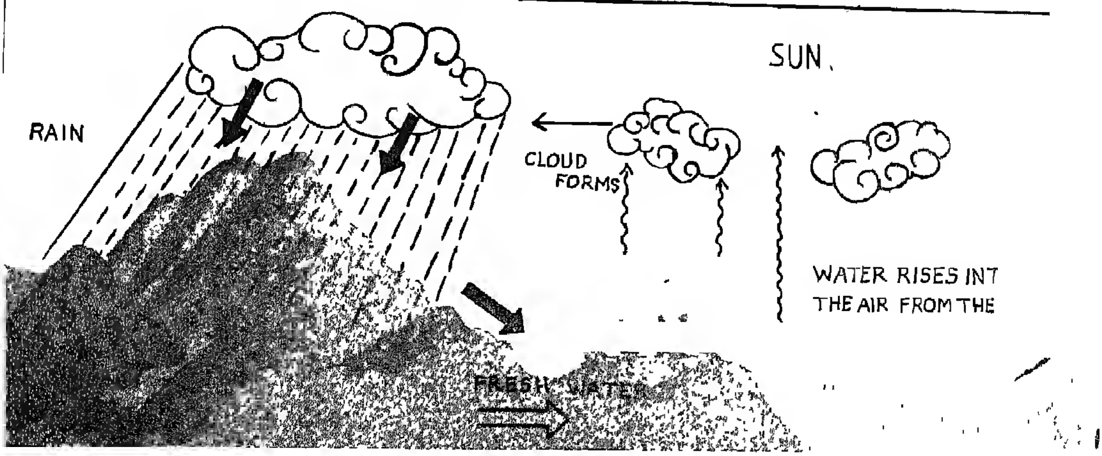
ANSWER THESE

1 Briefly describe the water cycle
2 Why is the water cycle important
3 Water dissolves many substan- therefore, it is a good ________
4 Name two liquids which are heav than water

10.5 *Hard and Soft Water*

You have learnt that water is . solvent Water from rivers, lakes, wells contains dissolved salts in differ

Fig. 10 8 *Water cycle in nature*



amounts These dissolved salts can change some properties of water. You know that pure water is tasteless The salts dissolved in it give water a taste You might have observed that water from some sources does not form lather with soap easily This is due to the presence of some types of salts dissolved in water Such water is called *hard water.* The water which gives good lather with soap easily is called *soft water.*

Activity 7

Take an equal amount of water sample from a well and a tap in two different test-tubes or glass tumblers Keep them at suitable places. Take a small quantity of soap and add an equal amount of it to each sample of water Shake both the samples for equal time and observe. In which sample do you get maximum lather? The sample in which you get maximum lather is soft water

Activity 8

Take two test-tubes or glass tumblers. Fill them about half with tap water In one of them add a pinch of common salt. In the other, add a pinch of calcium chloride or magnesium chloride. Add 10 drops of soap solution to each test-tube or glass tumbler Shake them well. What do you observe? The test-tube or glass tumbler which contains calcium chloride or magnesium chloride will give very little lather

Thus, the presence of calcium and magnesium salts in water makes it hard Some salts make water hard, others do not Hard water forms a curd-like dirty white substance with soap

The hardness of water can be removed by boiling it or treating it with chemicals such as washing-soda.

Hard water is suitable for drinking The hardness of water makes it unsuitable for some purposes If hard water is used for washing clothes with soap, dirt cannot be removed easily Therefore, hard water is not suitable for washing clothes Hard water is also not suitable for industrial uses

You must have seen a white dirty coating of salts formed inside the vessel in which hard water (water from a well) is boiled very often. This coating is also frequently seen on the surface of immersion heater and electric kettle which are used for boiling hard water Many chemical industries remove hardness of water by chemical treatment.

Answer These

1 Fill in the blanks

(i) The hardness of water is due to __________ dissolved in it

(ii) The salts of __________ and __________ make water hard

(iii) The hardness of water can be removed by __________ and treating with __________.

(iv) Soap gives __________ lather with hard water

2. How will you distinguish between hard and soft water?

10.6 *Uses of Water*

You already know about the domestic uses of water A person requires about two or three litres of water every day for drinking This water is lost in various ways To remain alive, we must make up this loss of water (Fig. 10.9)

Industries are established only where plenty of water is available. Chemical industries need more water

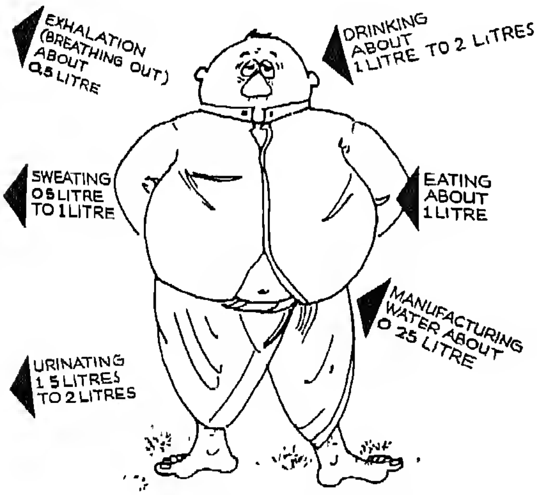


Fig. 10.9 *Gain and loss of water*

Many animals and plants live in water (Fig 10 10)

Water is a good medium for transport of goods. Boats, ships and sail boats carry men and materials from one place to another At many places, flowing water in rivers is used to transport timber (logs of wood).

Water acts as a carrier of disease-causing germs Some water-borne diseases are diarrhoea, typhoid and jaundice. The germs ge into water through human waste, animal dung, rotten plants and dead animals

The seeds of several plants are transported by water. The seeds fall on water, float and are carried away to far-off places Several varieties of plants spread from one place to another in this manner.

Many people live on boats. They have their home on water. They live on boats in lakes and rivers. They usually earn their livelihood by fishing or transporting people

Water also provides recreation and sports facilities People go to lakes, rivers or sea for swimming, boating or water skiing.

Fig. 10.10

ANSWER THESE

1. Water acts as a __________ for disease-causing germs
2. Name two water-borne diseases.
3. Name two activities where water acts as medium of transport

10.7 *Conservation of Water*

You have learnt that many human activities require water After use in home, in agriculture or in industry, water gets contaminated (Fig 10 11). The used water may contain waste and harmful substances called *pollutants*. Sewage and garbage also cause *water pollution*.

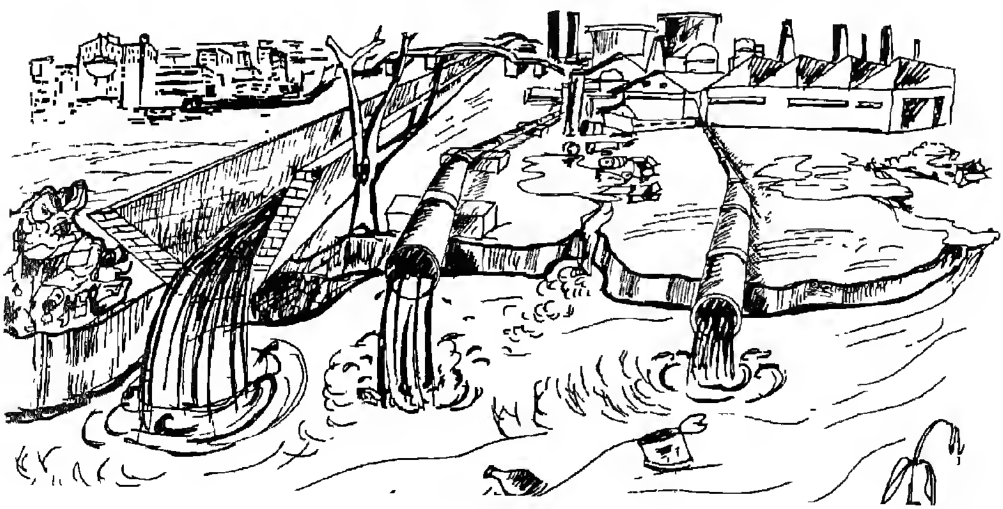
If we drink polluted water, it can cause diseases In our country most of the rivers and lakes are polluted. Efforts are being made to control water pollution.

The pollution can be controlled, to some extent, by various methods It can be done by avoiding direct disposal of the household, industrial and other wastes into the sources of water like rivers and lakes. Pollution of water in the wells can be prevented by covering the wells We should avoid cleaning utensils and washing clothes near the sources of water It would also help to keep them clean

Water is a natural resource and is freely available. You can go to a well or a river or a pond and draw water But the water you get may not be safe for drinking. To make it safe for drinking, it is desirable to boil it or treat it with some chemicals like potassium permanganate and chlorine tablets In cities, water is supplied through pipes after treatment

You know that potable water, that is water which is safe for drinking, is not available in plenty Water must not, therefore, be wasted It should be *conserved Conservation means careful and economic use*. It also means less wastage. In order to conserve water everyone should make efforts in this

Fig. 10.11 *How water gets polluted*



direction. Efforts should also be made to minimize the pollution of the sources of water You are already familiar with many uses of water In many areas water is drawn from wells in large quantities for use in agriculture and at home When rainfall is insufficient, the water level in the wells goes down It, therefore, becomes difficult to draw water from them Forests help in increasing the rainfall We should, therefore, not destroy forests and should grow more trees.

The scarcity of water can be overcome by collecting rain water in tanks, by building underground storage, or by constructing small dams

ANSWER THESE

1. How is water polluted?
2. How can water wastage be minimised?
3. Why should we protect our forests and grow more trees?
4. Name two pollutants

YOU NOW KNOW

- Water is essential for all living beings.
- Ocean is a major natural source of water Other sources are lakes, ponds, rivers, streams and rain.
- Pure water is a colourless, odourless, tasteless and transparent liquid
- Water exists in three states—solid, liquid and gaseous
- Pure water freezes at 0°C and boils at 100°C
- The water cycle in nature is a continuous process.
- Fresh water is of two types—hard and soft.
- Hardness of water is removed by boiling it or treating it with some chemicals
- Hard water is unsuitable for washing clothes and industrial uses
- Water is used for drinking, washing, cleaning, irrigation, and generating electricity and in industries
- Water is a means of dispersal of seeds and fruits and of spreading germs It is also used for transporting passengers and goods
- Many plants and animals live in water.
- In some living objects, water acts as a medium of carrying minerals and food from one part to another
- Water is a major natural resource and needs to be conserved
- Fresh water is polluted by various human activities
- There is scarcity of water for drinking and irrigation in our country Therefore, water should be used economically and should not be wasted

NOW ANSWER THESE

1. Mention five uses of water
2. Name three sources of water

3. How will you show that water contains (i) dissolved air, and (ii) dissolved salts
4. Natural water is never pure. Why?
5. Is it necessary to purify the pond water before drinking? Why?
6. Why is hard water not preferred in washing and in industries?
7. Draw a labelled diagram to explain the water cycle
8. Name two methods by which hardness of water can be removed
9. Why is conservation of water essential?
10. Explain the following terms:
    (i) Pollution of water
    (ii) Pollutants
11. Name two diseases which are caused by drinking polluted water
12. Fill in the blanks:
    (i) Water is one of the basic constituents of all ______
    (ii) The major natural source of water is ______.
    (iii) Water exists in ______ states
    (iv) Water at room temperature exists as a ______
    (v) Water freezes into ice at ______
    (vi) Water boils at ______
    (vii) Water vapours in air ______ into water droplets resulting in a rainfall
    (viii) ______ of water can be removed by boiling it or treating it with washing soda
    (ix) Water helps in transporting ______ and ______
    (x) The sources of fresh water get ______ by human activities, sewage, etc

UNIT ELEVEN

Energy

YOU KNOW that force can make a body move or stop. Force can also change the shape of a body and the direction of motion of a body When you apply force on a football while playing, work is said to be done. In order to do work, you use what is called energy You have learnt earlier that every change involves energy In this unit, you will study about the relationship between work and energy. You will learn about different forms of energy and their sources You will also learn why you should save coal, petrol and wood and use alternative sources of energy such as water and sunlight

11.1 *What is Energy?*

If you work in your field or school for a long time you feel tired Similarly, when you play for a long time you feel tired How do you know that you are tired? Your ability to work is reduced The ability to do work is called energy. It means that when you are tired you have less energy The question now arises· Why is your energy reduced? Obviously, it is reduced because you did some work It means you use energy to do work. When you say that you are feeling energetic today, what do you mean by this? You perhaps mean to say that you could run a long distance or play a lot or do a lot of work. Thus you see that work and energy are related.

11.2 *What is Work?*

You do various kinds of work When you say 'I am working', perhaps you mean to say that you are doing something When you learn your lesson, mental work is said to be done When you push or pull an object and the object does not move, physical work is said to be done. Suppose you pull a bucket of water from a well, you do mechanical work in pulling the bucket Mechanical work is said to be done when on applying force an object moves through a distance Whether you do physical work or mental work or mechanical work, energy is always used.

In which of the events shown in Fig. 11.1, is mechanical work being done?

Many a time, you have to know how much work has been done. How do yo

Fig. 11.1 *Some common activities*

find the amount of work done? To find it look at Fig 11.2 (a) and (b)

In Fig 11.2 (a) Student A has moved the box to a larger distance than Student B. The force required to move the box is the same in both cases. The work done by Student A is greater than that done by Student B

You can see from Fig 11.2(b) that both Student A and Student B have moved the boxes through the same distance How many boxes were moved by each of them? Student B has moved two boxes whereas Student A has moved only one Thus Student B has done more work than Student A since Student B applied greater force than Student A.

It can, therefore, be concluded from the above two observations that mechanical work done depends upon (i) the distance moved by an object and (ii) the magnitude of force applied to move the object.

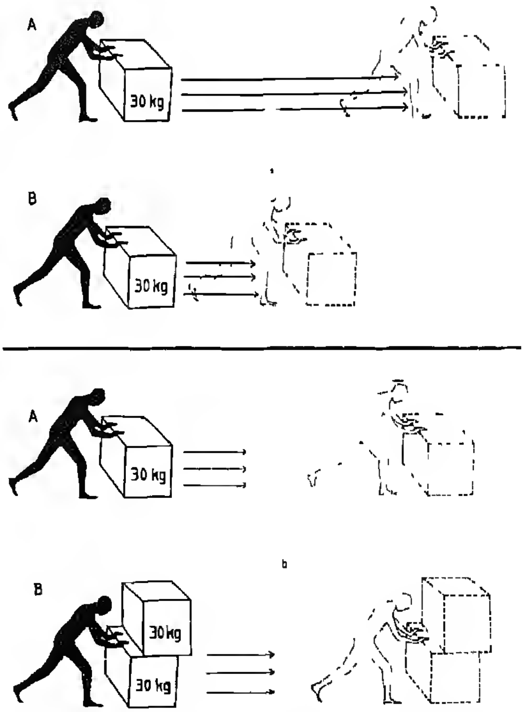


Fig. 11.2 *(a) The boxes are moved through different distances (b) The boxes are moved through the same distance*

Let us further explore the relationship between work and energy To do this let us perform the following activities

Activity 1

Take a brick Place it gently on a small piece of earthen pot Does the piece of earthen pot move from its place? Now lift the brick up to the height of your shoulder Did you do any work to lift the brick? Now drop the brick so that it falls on the piece of earthen pot What happens to the earthen pot? Do you see the pieces of earthen pot moving?

When you placed the brick on the piece of earthen pot gently, it did not have enough energy to apply a force large enough to break the piece of earthen pot. The work which you did in lifting the brick, got stored in it in the form of energy. The brick thus acquired more energy. The energy acquired by the brick enabled it to exert force large enough to break the piece of earthen pot and move its pieces in different directions Thus, you see that the work done on a body can get stored in it in the form of energy The stored energy can do work A body possessing energy is capable of doing work

Activity 2

Take a piece of cardboard and keep it in an inclined position (Fig 11 3) using a brick Take a cylindrical object such as a piece of pipe or a torch cell.

Put the cylindrical object at point B on the cardboard Put a matchbox at A Release the cylindrical object from B and let it roll The cylindrical object will carry the matchbox with it If the matchbox and the cylindrical object do not move together, repeat the activity Note the distance moved by the matchbox from point A

Take the cylindrical object again and place it at point C Replace the matchbox at A Release the cylindrical object Note the distance moved by matchbox from point A

(i) In which case was the cylindrical object lifted higher from the ground?
(ii) In which case was more energy stored in the cylindrical object?
(iii) In which of the two cases did the matchbox move a larger distance?
(iv) In which of the two cases was more work done on the matchbox?

Your observations will indicate that the greater the energy in a body, the greater is the work it is capable of doing

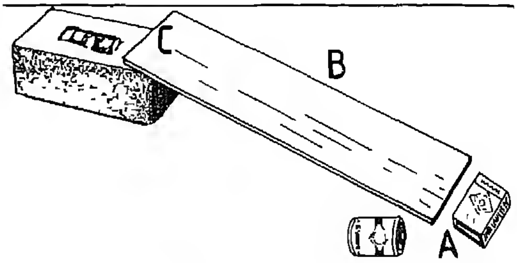


Fig 11 3 *A moving object moves the match box*

ANSWER THESE

1 State two examples in which no mechanical work is done on a body when a force acts on it
2. Write 'T' against those statements which are true and 'F' against those which are false
   (i) Whenever a force is applied on a body, mechanical work is done on it
   (ii) Work done is independent of the magnitude of force
   (iii) If a body is lifted above the ground, its energy increases
   (iv) A body possessing energy is capable of doing work
3 State the factors on which the mechanical work done depends

11.3 *Different Forms of Energy*

There are different forms of energy One form of energy can be converted into another form

MECHANICAL ENERGY

In Activity 1 you saw that a brick raised to a height is capable of doing work Also, in Activity 2 you learned that a moving object possesses energy and can do work. The energy possessed by a raised object as well as by an object moving with speed is called mechanical energy

Suppose you stretch the rubber of a catapult with a stone in it On releasing the rubber the stone moves away with a speed A stretched rubber is capable of doing work. The energy possessed by a stretched rubber is called mechanical energy

Similarly when you wind your alarm clock, you wind a spring attached to it When the spring unwinds itself it makes the clock work The energy possessed by a stretched spring is also called mechanical energy

CHEMICAL ENERGY

If you take a toy rocket and cut it open, you will see some chemical substances in it When the 'rocket' is fired, chemical reaction starts and it shoots up When the chemicals are used up the reaction stops and the 'rocket' falls down.

A torch cell consists of a paste of certain chemicals, a carbon rod and a zinc case When a torch or a radio containing fresh cells is switched on, it starts working Here also the chemicals present in the cell provide energy When the chemicals are used up, the cell stops working

In these cases the energy stored in the molecules of the chemicals is converted into different forms of energy

Matches, wood, coal, kerosene, diesel and petrol also have chemical energy stored in them

The food which you and animals take also provides energy If you are hungry, you feel weak and find it difficult to work. After taking food, you feel energetic again The food has chemical energy

stored in it Your body as well as that of animals is able to change the chemical energy stored in the food into muscular energy for their use You need energy to live When you move about, run, play or exert force, the food you have taken provides you energy You use the energy of some animals like the horse or bullocks to pull a cart or to plough fields Even when you are asleep some internal parts of your body are in motion You continue to breathe and during this process your lungs expand and contract Your heart also is moving all the time pumping blood around your body Thus, you use energy even when you are asleep

HEAT ENERGY

Take some water in a beaker and heat it While the water is being heated, observe the water carefully. You will find some streaks of water rising up To observe the streaks clearly add one or two crystals of sugar into the water When heated, the water from the bottom of the beaker moves up The energy supplied by heat makes the water move up.

When you boil water in a kettle covered with a lid, the lid moves up and down when water boils It is due to the heat energy of the steam. James Watt used this experience to invent a steam engine

You must have seen a rotating lantern during festivals Heat energy is responsible for the rotation of these lanterns Thus you see that heat is a form of energy

LIGHT ENERGY

Have you ever seen light moving any object Perhaps not. In our daily life we do not see light moving any object because light is a very feeble type of energy Therefore light cannot move heavy objects If the object is very light, light can move it. You must have heard about the Halley's comet (Fig 11 4) which was seen in early 1986 after 76 years. It has a tail which goes on increasing as it comes nearer to the sun Do you know why the tail increases? There are very light dust particles around the comet. When the beam of sunlight falls on them, they are pushed away and form the tail of the comet Thus, light pushes the dust particles of the comet Hence, light is a form of energy

When light falls on a photographic film, a chemical change takes place Due to this change, an image is formed on the film You know that energy is involved in a change Thus, light is a form of energy.

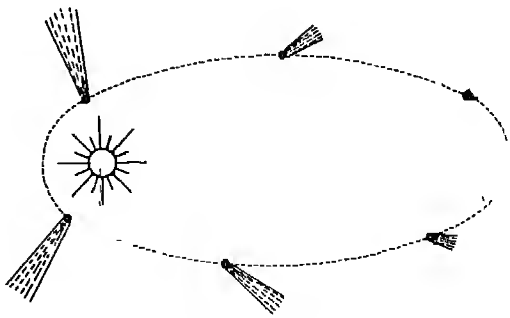


Fig 11 4 *The tail of Halley's comet becomes longer when the comet is near the sun*

SOUND ENERGY

Like light, sound is also a very feeble type of energy. You must have experienced that sometimes thunder shakes the house. Sometimes you hear loud claps of thunder. How do you hear these? Your ears have eardrums. When you hear the thunder, the eardrums begin to vibrate (move back and forth). You are thus able to hear the sound. Similarly, if you hit the skin of a *dholak* or *tabla*, the skin starts moving back and forth rapidly. This rapid back-and-forth motion is called vibration. Sound is produced when an object starts vibrating. Similarly, if you pluck the string of a *sarangi* or violin, it starts vibrating and produces sound. Therefore, sound can make the objects vibrate and vibrating objects produce sound. From these examples it is clear that sound is a form of energy.

ELECTRIC ENERGY

When you switch on a fan, electric current passes into it and the fan starts revolving. Thus, you see that electricity can produce motion. Hence, electricity is also a form of energy. In agriculture electric energy is used to run a motor to pump out water from a well. Electric energy is also used to run machines in factories, electric trains, lifts and flour mills.

ANSWER THESE

1. How will you show that electricity is a form of energy?
2. Name the different forms of energy.
3. How will you show that heat is a form of energy?

11.4 *Sources of Energy*

You have studied that food is a source of energy for animals, including man. Plants are the main source of food for all animals. Plants use sunlight to make food. This food remains in the plants in the form of chemical energy.

Wood from plants is also used as a fuel. When wood burns, chemical energy changes into heat and light energy, which is used to do work. Thus wood is a source of chemical energy.

Coal is also used as a fuel to provide energy. Coal is formed after millions of years from the trees which get buried under the earth. We already know that trees contain chemical energy. Coal, therefore, contains chemical energy.

Petrol and diesel are used in cars, scooters, tractors, trucks, diesel train engines, aeroplanes and other vehicles as fuel to provide energy. Without fuel a vehicle will not move. Kerosene and natural gas are also used as fuels in lamps and stoves. Petrol, diesel and kerosene are obtained from petroleum. Petroleum is found deep under the earth's crust. It is formed from the remains of sea plants and animals, which got buried millions of years ago. You know that plants and animals have chemical energy in them. Therefore, coal, kerosene, petrol, diesel and natural gas contain chemical energy.

These fuels are called fossil fuels

ELECTRIC ENERGY FROM COAL

Coal is also used to generate electricity. On burning, coal produces heat This heat is used to boil water and produce steam The steam runs the turbine and generates electricity The place where electricity is generated by using coal, is called thermal power-station (Fig 11.5) Find out the names of some places in and around your state where thermal power-stations are located

The fossil fuels take millions of years to form Once they are used up, they will not be available again These sources are non-renewable sources of energy If they are used continually at the present rate, they will soon be exhausted There is, therefore, a need to save them and use alternative sources of energy Some of the alternative sources of energy are water, wind, sun and biomass

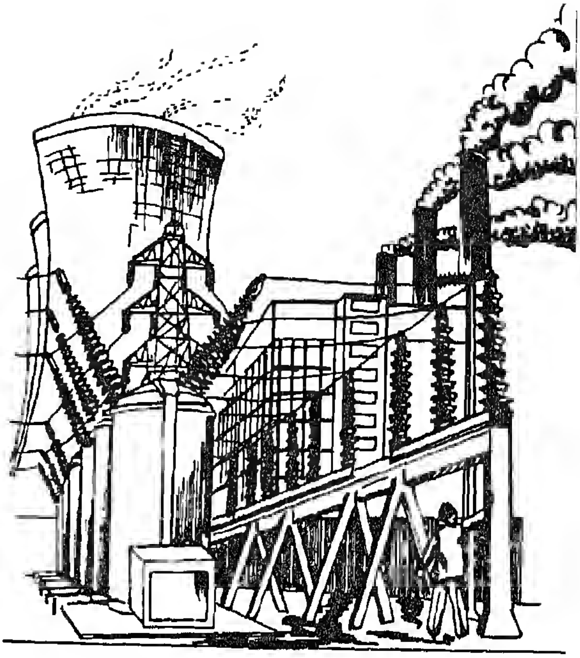


Fig 11 5 *Thermal power-station*

SOLAR ENERGY

The sun has been providing us with heat and light energy free of cost It is expected to continue providing us energy for millions of years to come You have seen that plants use the light energy of the sun to make food Plants are the source of food for animals Since plants get their energy from the sun, the sun is a source of energy for animals Even the energy in butter, milk and eggs comes from the sun The sun is, in fact, the ultimate source of energy You can understand this from Fig 11 6

Scientists all over the world are trying to make use of the energy from the sun (Solar Energy) They have been able to make cookers, water heaters and cells which work using the solar energy Solar cookers and solar heaters are being used to cook food and supply hot water in large buildings and hotels Solar cells convert sunlight into electricity. They have been used to supply electricity on a small scale for domestic use in villages Solar cells are also used to provide energy to manmade satellites Find out the source of electricity in your area. Find out

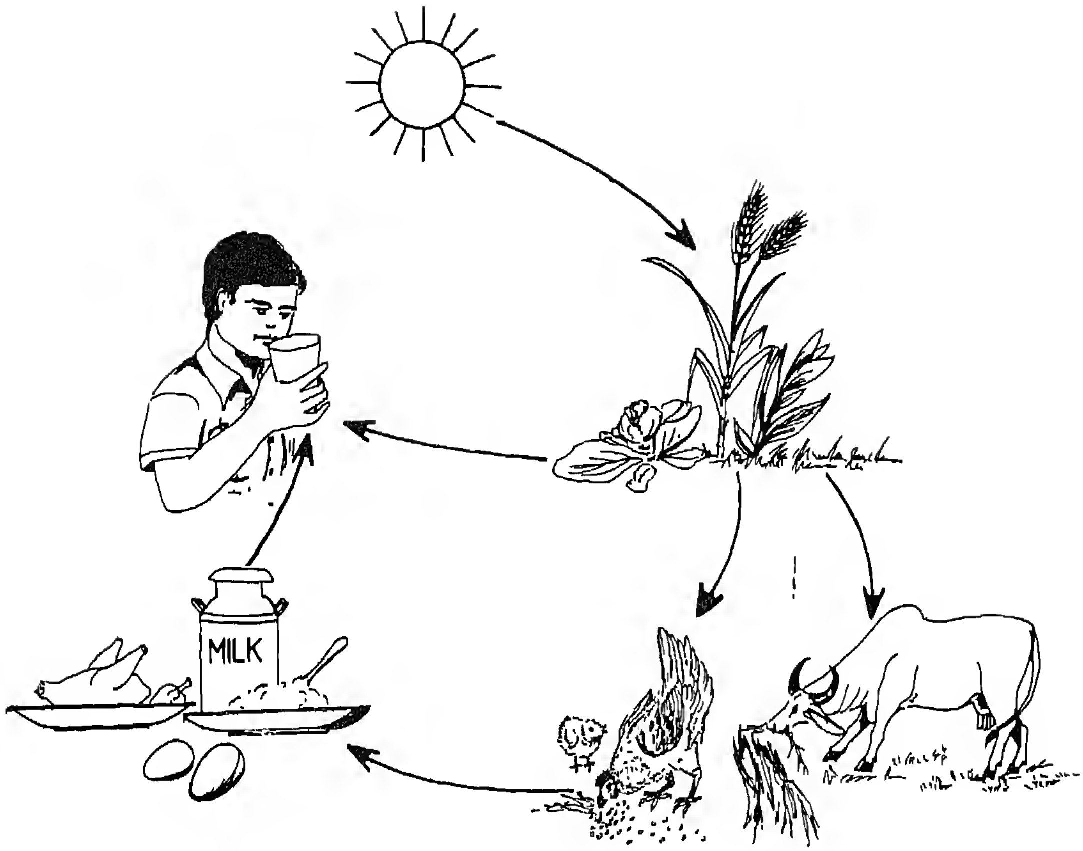


Fig. 11.6 *The sun is the ultimate source of energy*

also if there is any building in your locality in which solar heaters are being used

WIND ENERGY

Wind also provides energy free of cost and does not pollute the environment Make a wind-vane *(phirki)* Blow air on it. It will start rotating. (Fig 11.7)

This idea is used in making the windmill, which is a big wind-vane Many parts of our country are windy on most days. In some of these places, wind energy is used to turn windmills These windmills are used to pump water and generate electricity

ENERGY FROM WATER

The running water is a source of energy. It is free and does not pollute the environment You must have seen that as rivers flow, they carry mud and sand

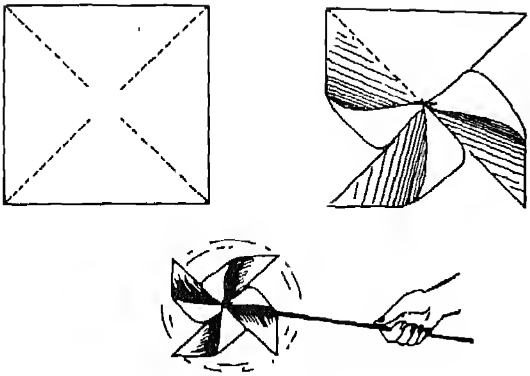


Fig 11.7 *Wind rotates the wind-vane (phirki)*

with them The flowing water is also used to transport plants and logs of wood from one place to another in our country

Activity 3

Make a water-wheel using a tin sheet as shown in Fig 11 8 Pour water on the wheel from a height You will see the wheel turning Thus, running water provides energy to rotate the wheel This idea is used to produce electricity Water is stored in a dam When water falls from a height, it turns big turbines (Fig. 11 9) The turbines are like big water-wheels The rotating turbines help to generate electricity

The power-stations where electricity is generated by using the energy of water are called hydel power-stations Find out the names of some such stations in and around your state, if any.

ENERGY FROM BIOMASS

It is the oldest source of energy Biomass means the waste material and dead parts

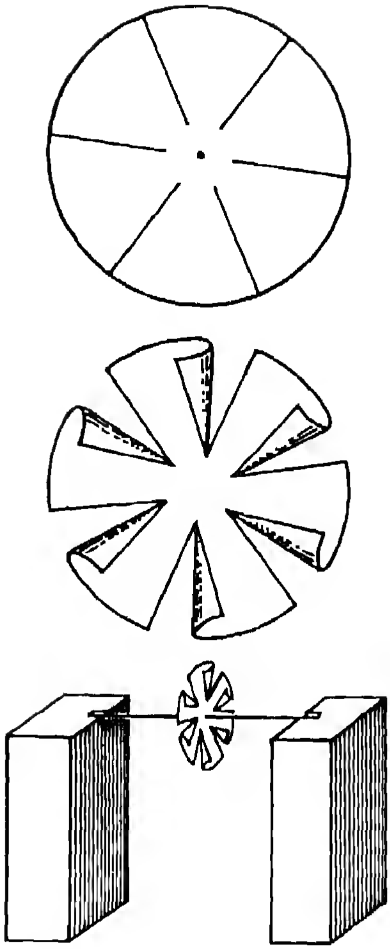


Fig. 11.8 *Water-wheel*

of living objects Biomass includes garbage, industrial waste, crop residue, sewage and wood There are two main ways of using biomass as a source of energy One is to burn the dry biomass directly to produce heat and generate steam. Another method is to produce methane gas by the decomposition (breaking down) of the biomass in the

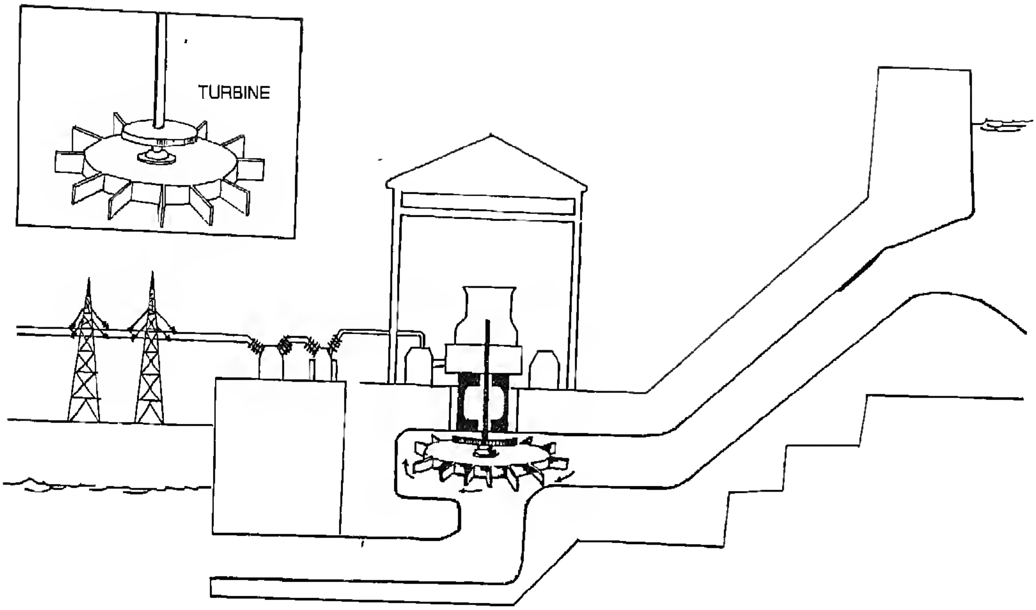


Fig 11.9 *Moving water turns turbines to produce electricity.*

absence of oxygen This gas can be used for cooking, lighting, etc.

Water, wind, sunlight and biomass are called the renewable sources of energy, since they can be used again and again Moreover, they are freely available and do not pollute the environment Efforts are being made to use to the maximum the energy available from them.

ANSWER THESE

1 Name the source of energy in a hydel power-station and a thermal power-station

2 What is meant by renewable sources of energy? Name three renewable sources of energy

3 Why should you prefer the renewable sources of energy to the non-renewable sources?

4. Name two devices which work on the solar energy

YOU NOW KNOW

- — Work is said to be done when on applying force a body moves through a distance
- — The work done in raising a body is stored in the body in the form of energy Thus, a body which is raised higher above the ground, has greater energy.
- — A body possessing greater energy is capable of doing greater work and vice versa
- — There are different forms of energy such as heat, light, sound, chemical and electric
- — Running water, wind, sunlight, coal, wood, natural gas, petrol, diesel and kerosene are some of the sources of energy.
- — Coal, petrol, natural gas and diesel are non-renewable sources of energy whereas wind, sunlight, flowing water and biomass are renewable sources

NOW ANSWER THESE

1 In a cracker, which kind of energy is:
   (i) stored in the cracker
   (ii) required to ignite the cracker.
   (iii) given out when the cracker explodes
2 Explain how the energy from the sun gets stored in wheat
3. Name at least two devices which work with electric energy
4. State the factors on which the work done on a body depends
5 State the relationship between work and energy.
6 Name three sources of chemical energy
7 Distinguish between renewable and non-renewable sources of energy
8 Why is coal called a fossil fuel?
9 Why are hydel power-stations preferred to thermal power-stations? Give three reasons
10 Name two fossil fuels
11 Fill in the blanks
   (i) The torch cell is a source of __________ energy
   (ii) Cooking gas is a __________ fuel
   (iii) Wind is a __________ source of energy
   (iv) In hydel power-stations the energy of __________ is used
12 A boy tries to push a truck parked on the roadside The truck does not move at all Another boy moves a bicycle through a small distance In which case was the mechanical work done more—on the truck or on the bicycle? Give a reason to support your answer.
13 To get salt, the sea water is collected in shallow salt pans on the seashore The water evaporates and salt is left behind Which energy brings about this change? What is the source of this energy?
14 Name the sources of energy for a wind mill and an electric fan.

Balance in Nature

YOU KNOW that air, water, soil and several living and non-living forms are all around us All these influence our lives All forms, whether living or non-living, are linked with one another Human beings grow grains. Grains are eaten by us and also by birds and rats All living forms, whether rats, birds or human beings drink water Water supports a lot of other forms of life

Do you know how man is dependent on other living and non-living forms, how animals are dependent on plants, and how plants are dependent on animals? How is this chain of mutual dependence maintained in nature?

12.1 *Interdependence of Organisms*

HUMAN BEINGS DEPEND ON PLANTS AND ANIMALS

In our day-to-day life we use several things which are obtained from either plants or animals (Figs 12.1 and 12 2).

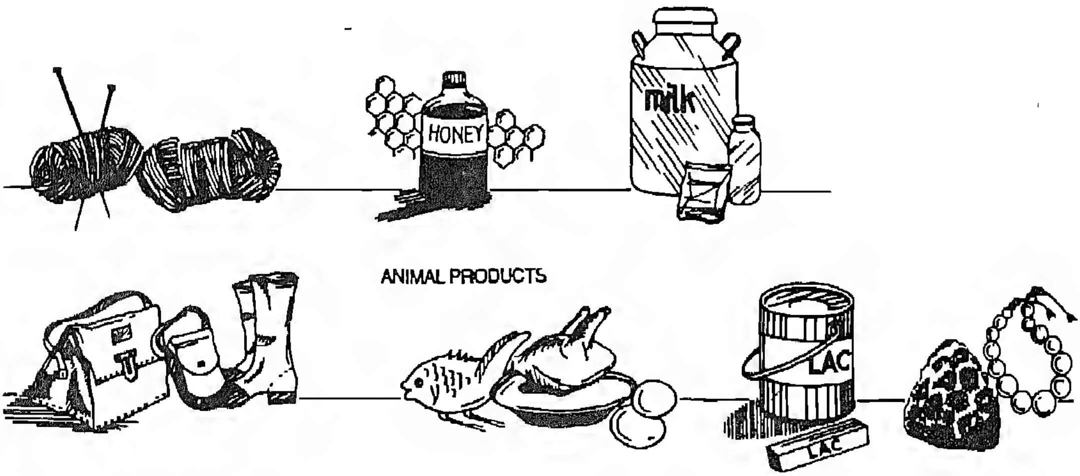


Fig. 12.1

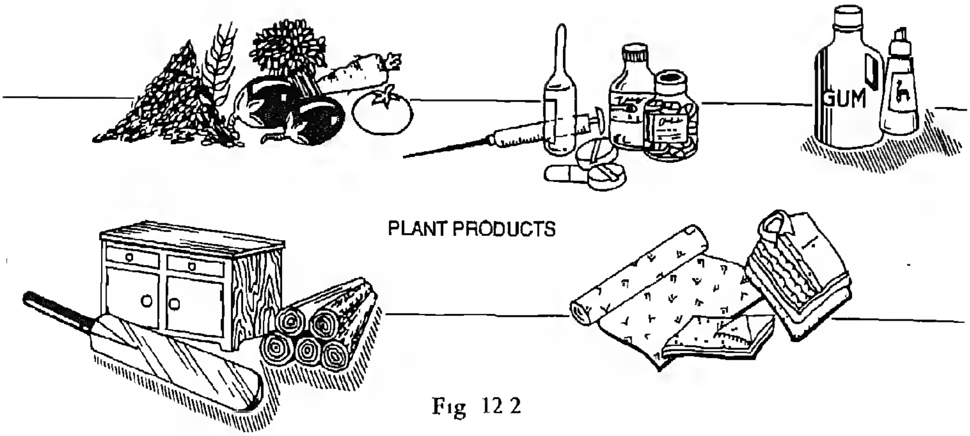


Fig 12 2

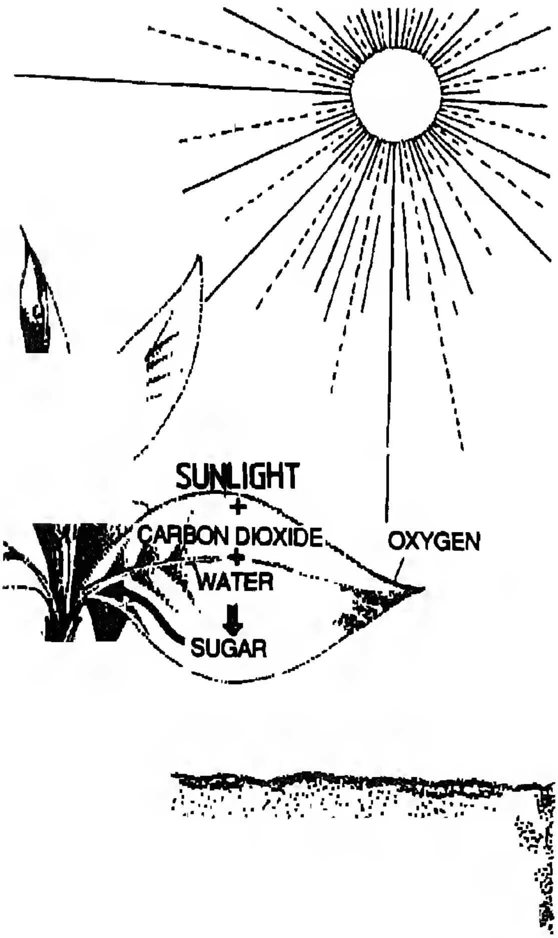


Fig 12.3 *Plants produce their own food.*

Activity 1

From the following things find out which are plant products and which are animal products.

Rubber	Paper	Coal
Silk	Dung	Cod-liver oil
Spices	Oil	
Coir mats/ ropes	Wax Match sticks	

Can you think how certain plants and animals affect our lives? Some plants are used for medicine Many animals are used as a means of transport and for ploughing fields, for example, the horse, the ass, and the ox.

PLANTS PREPARE THEIR FOOD

The green plants prepare their own food using water and carbon dioxide in the presence of sunlight (Fig 12 3).

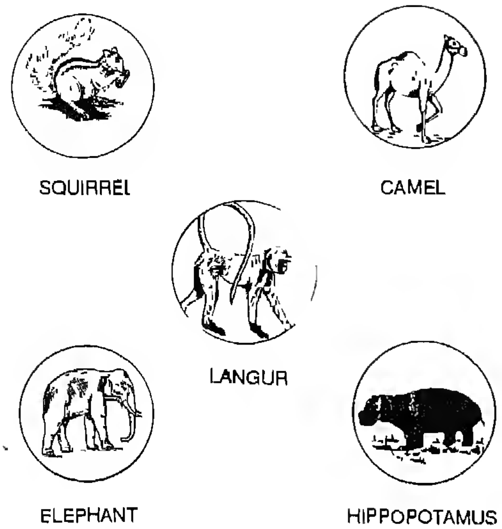


Fig 12.4 *Herbivorous animals*

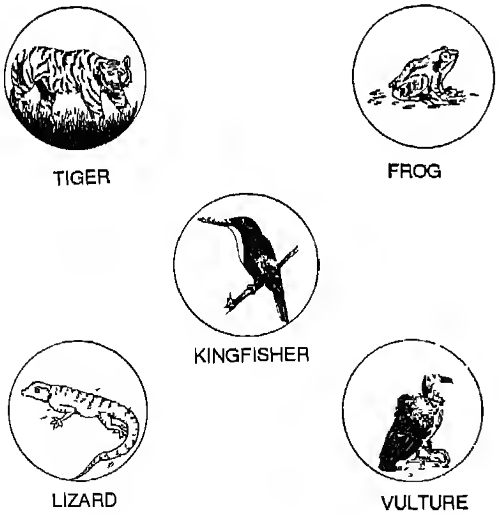


Fig. 12 5 *Carnivorous animals*

ANIMALS HAVE TO EAT FOOD

Both animals and plants need food to grow and survive. You already know that plants manufacture their own food Animals cannot manufacture their own food. Therefore they have to take food from outside As plants make their own food they are called 'producers' Animals have to consume plants or other animals to live and grow Therefore, they are called 'consumers'.

Some animals eat only plants. They are called *herbivorous animals* (Fig 12 4) They may eat grasses, leaves, fruits, grains or the bark of trees

Some animals eat only other animals. They are called *carnivorous animals* (Fig 12 5)

Some animals eat both plants and animals They are called *omnivorous animals* (Fig 12 6)

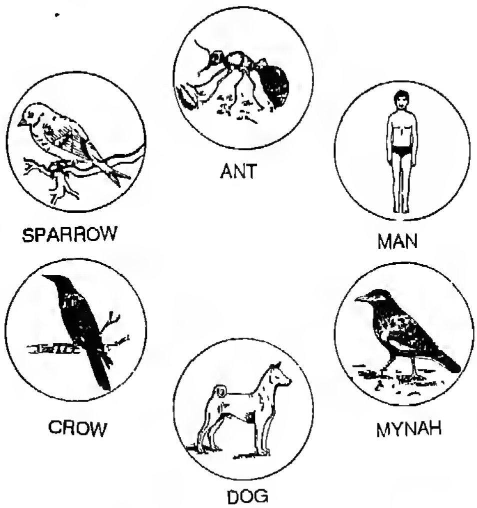


Fig. 12 6 *Omnivorous animals*

Activity 2

From Fig 12.7 make a list of the animals which eat only plants, of those which eat only animals and of those which eat both plants and animals

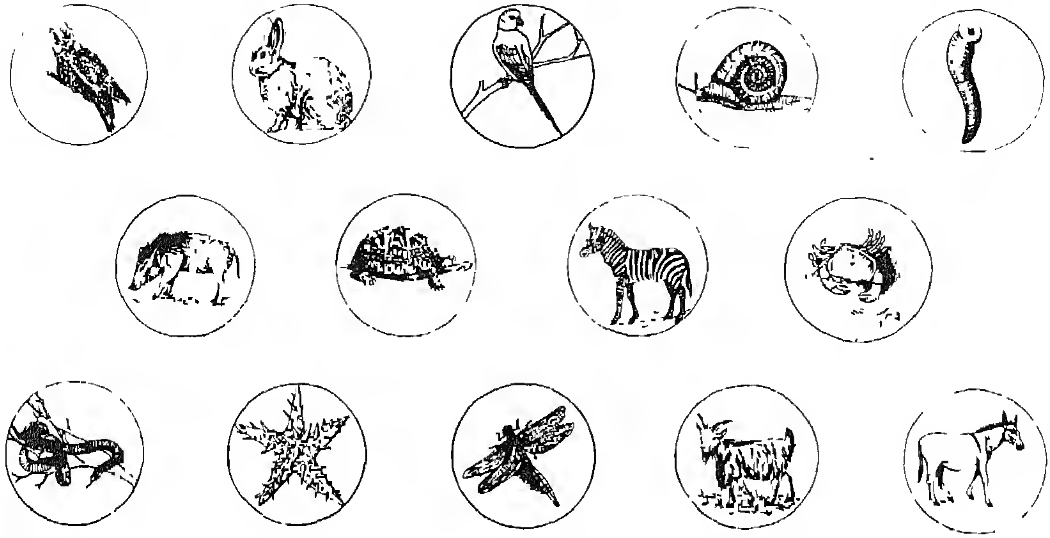


Fig 12.7

ANIMALS DEPEND UPON PLANTS IN MANY OTHER WAYS

You have learnt that animals depend on plants for their food Some depend on plants also for shelter Some make their homes in holes in the trees (Fig. 12.8)

Several birds use different types of plant materials to build their nests, such as dry sticks, leaves and cotton (Fig 12 9) Some spiders and insects also make their homes in the leaves Monkeys and apes also live in the trees. Most of them prefer sleeping safely on the branches of the trees Many insects live in trees and plants, for example, the ant, beetle, butterfly, grass-hopper, firefly, moth, wood louse, cricket.

Human beings make their homes by using plant material They also make furniture from the plant material Besides food items, there are several things made of plant materials that man uses every day

Plants provide shade and protection from heat and rain.

Human beings need both plants and animals for living Plants are also used for decoration

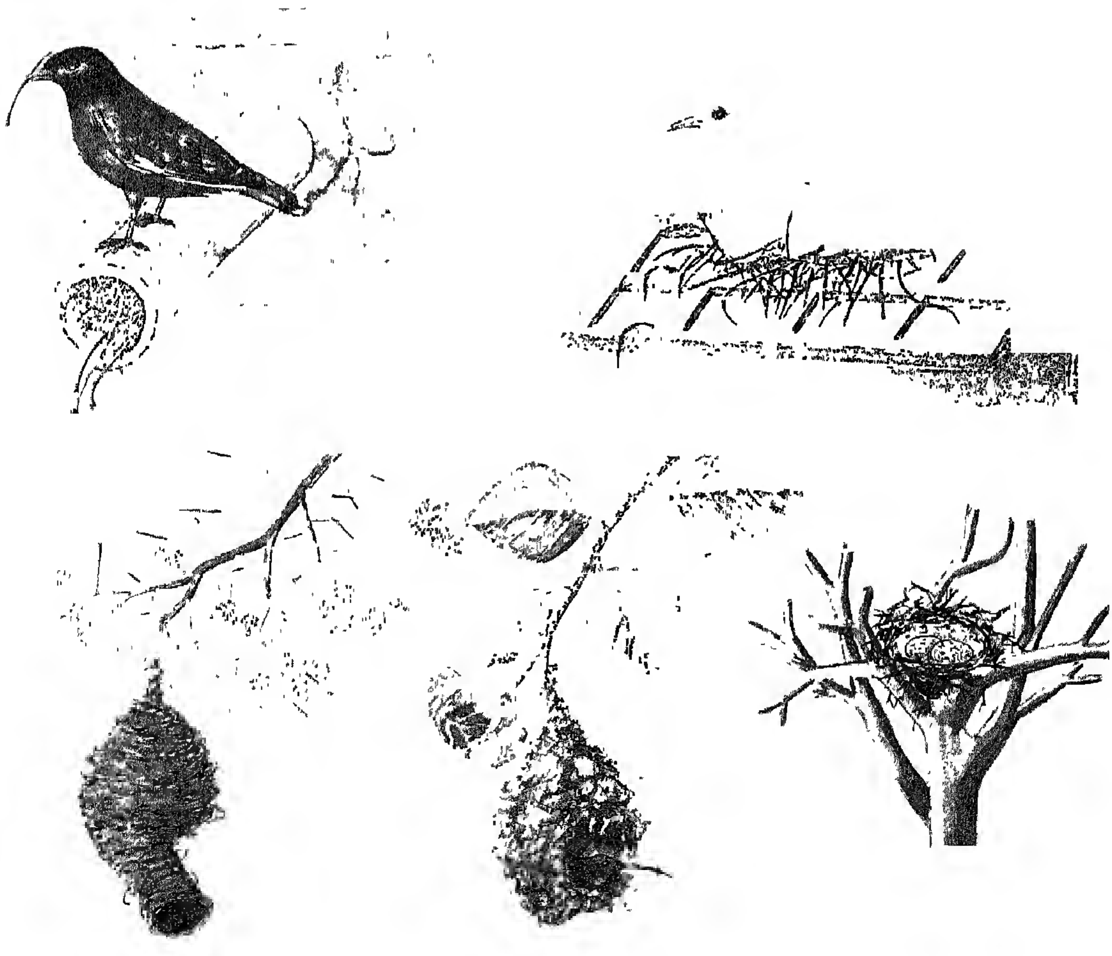
Activity 3

Make a list of the things

(i) you eat
(ii) you wear
(iii) you use in the classroom.

Fig 12.8 *Some animals live in the holes of trees.*

Fig 12.9 *Many birds make their nest with plant materials*



Classify the things in the table given below.

Source

Plants	*Animals*	*Neither Plants nor Animals*

Plants too depend on animals in many ways such as pollination, seed dispersal, irrigation (Fig 12 10)

The excreta of animals and the decomposed dead bodies of animals add nutrients to the soil. These nutrients then become available to the plants.

You have seen that plants and animals depend on each other in many ways However, neither plants nor animals would survive without the sun, soil, air and water.

ANSWER THESE

1. What is the difference between carnivorous and omnivorous animals
2 (a) Name three animal products which are useful to man
   (b) Name five plant products which are useful to man
3. Why is a cow called herbivorous animal?
4 Why are animals called consumers?

12.2 *Food Chain*

Non-living things are essential for the living organisms. Without the sunlight, soil, air and water, plants cannot prepare their food and grow If plants do not manufacture their food and grow, herbivorous animals would not get their

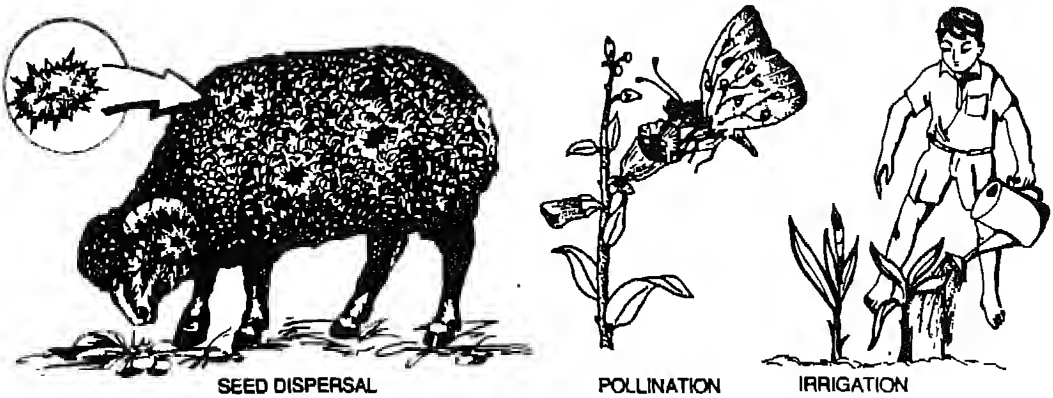


Fig. 12.10

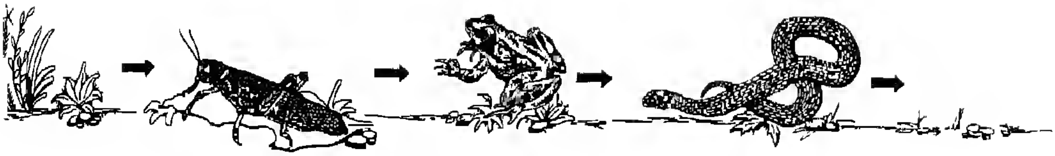


Fig. 12 11 *A food chain*

food. The carnivorous animals which eat herbivorous animals would then starve The whole process of *who eats whom* is called food chain (Fig 12 11) There are many food chains in nature

Food is required to get energy as well as matter All living things require energy to live and function They get energy from food What is the main source of energy on earth?

The sun is the main source of energy on earth How do plants obtain energy from the sun? The leaves of most plants are green because they contain a green pigment called *chlorophyll* Chlorophyll helps the plants in absorbing the energy from sunlight The absorbed energy is used by plants for manufacturing their food Energy is stored as food This process of making food is called *photosynthesis* When animals feed on plants they obtain this stored energy This energy helps animals live, grow, and remain healthy (Fig 12 12). In the food chain, the transfer of energy from one living organism to another takes place in the form of food. This is called ENERGY FLOW

Can you identify a simple food chain in your surroundings? Draw the food

Fig. 12.12 *Energy flows through food*

chain The snake eats the rat What does the rat eat? What does the rabbit eat? Who eats the snake? Have you ever seen any animals eating dead animals? Where have you seen them? You might have seen vultures or crows eating dead animals [Fig. 12.13 (a)]

Such animals are called *scavengers* Some of the insects, such as certain beetles, are scavengers Hyena is also a scavenger

DECOMPOSERS ARE ESSENTIAL COMPONENTS OF FOOD CHAINS

Dead animals and plants, fallen leaves, left-over food material rot after some days This process of rotting is called *decomposition* Certain living organisms such as bacteria, help in this process So these bacteria are called decomposers [Fig 12 13 (b)]

You know that all living organisms are made up of matter. Food provides necessary matter for building the body When organisms die, the process of decomposing takes place In this process, the body matter of the dead organisms is broken up into simple compounds Thus the matter returns to the soil

ANSWER THESE

1 Why is food necessary for us?
2 What is a food chain?
3 What would happen if all birds are destroyed?

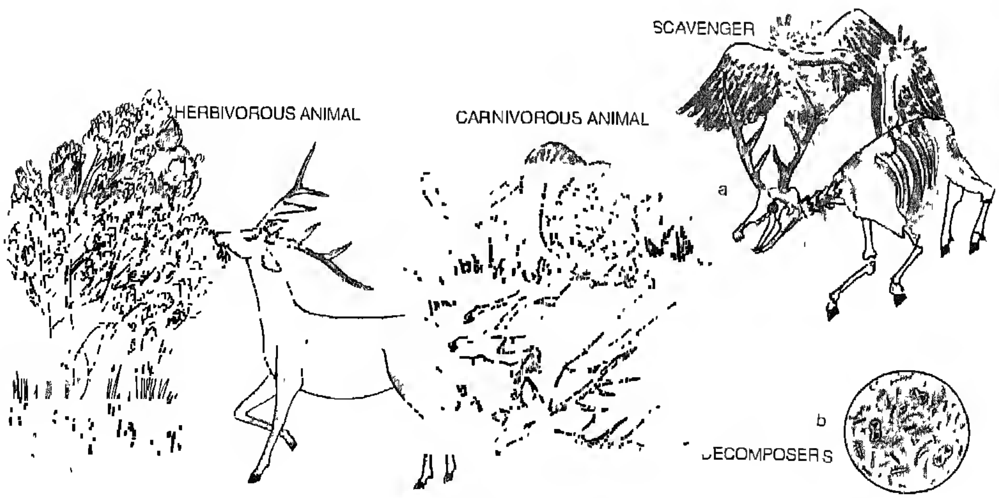


Fig. 12.13

12.3 *Balance is Essential in Nature*

You have learnt that all living things depend upon other living things. Living things also depend upon non-living things

Take the case of a field where food grains are grown Small insects live on the plants. They are eaten up by birds Plants require air, water and soil If there is any shortage of these plants, insects will die.

Now suppose all birds are destroyed. There would be no birds to eat the insects. Then, all the insects would increase in number. This large number of the insects would, in turn, destroy the crops The result would be that human beings and various other animals which are dependent on the crops would be affected. Thus, disturbing any part of the food chain would disturb the balance in nature

Actually what happens in nature is that when more insects are available, more of these are eaten up by birds Therefore, all forms not only depend upon one another, but also keep a check on all others This whole process results in a balance which exists in nature This is called the balance in nature

HUMAN BEINGS DISTURB NATURE

Man has been constantly destroying forests for his need of fire wood, furniture and timber and for industrial and agricultural uses As a result, a variety of wildlife such as birds, insects, snakes, tigers and deer, lose their habitat Not only this, by cutting down plants and trees, the soil becomes loose Once the soil becomes loose, the rain washes away the loose soil Moreover, by destroying trees, the total rainfall is reduced This leads to formation of deserts and wastelands on earth You have learnt earlier that the roots of plants and trees help in holding the soil The soil helps in the percolation and retention of water in the soil. Thus, by destroying the plants and trees or by cutting the forests the balance in nature is disturbed Who disturbs the balance in nature? This balance is disturbed by human actions

> Do you know that 10 to 20 per cent of the food grains produced in India are consumed or destroyed by rats?
>
> A pair of rats is capable of reproducing 880 rats in one year
>
> Snakes kill rats for food So the snakes help us to protect our food grains.
>
> Can you imagine what would happen if we kill all the snakes? Three hundred and fifty varieties of snakes are found in our country. Of these, only four land snakes are poisonous. So all the snakes are not dangerous for us Should we then kill snakes just at sight?

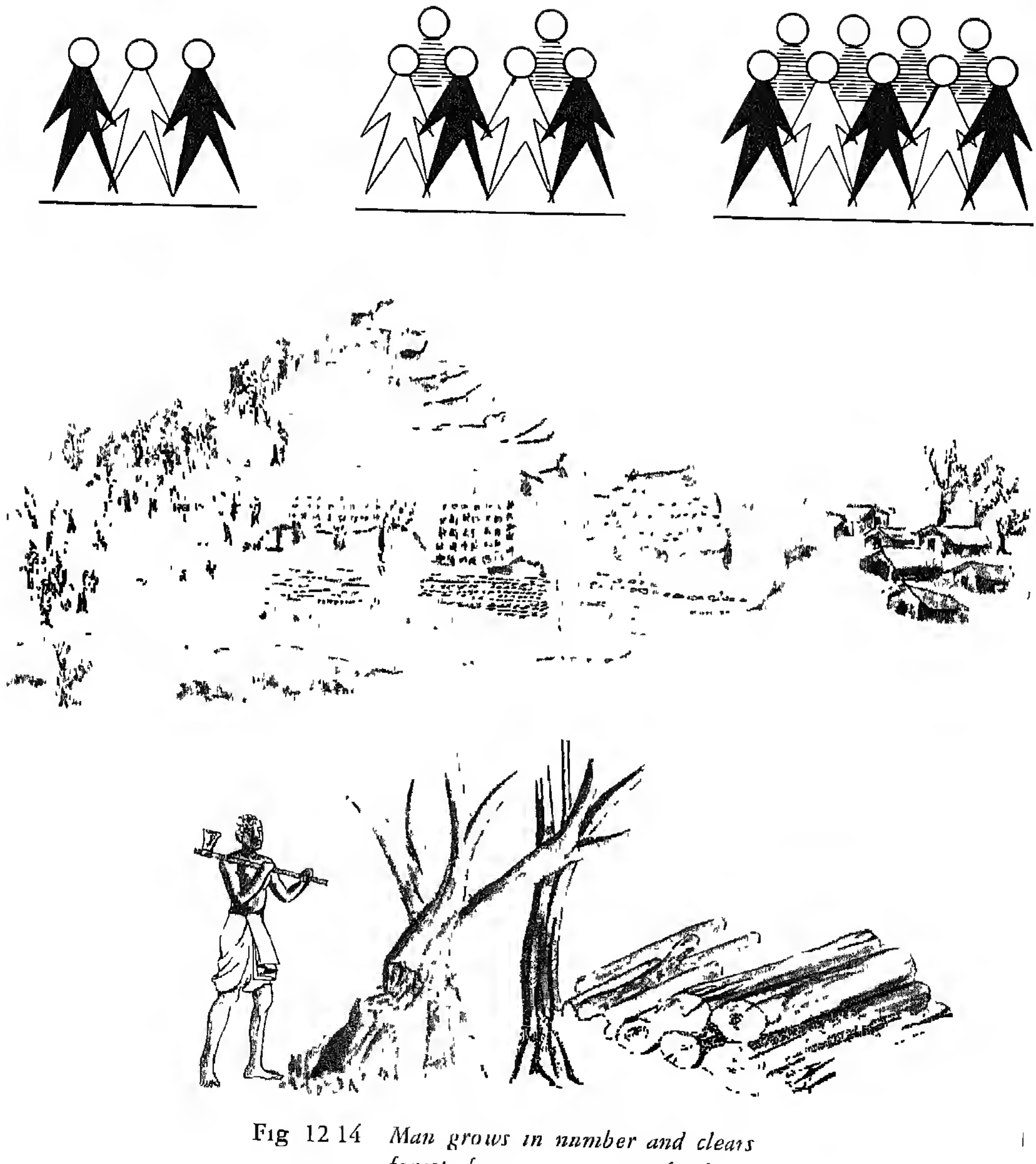


Fig 12.14 *Man grows in number and clears forests for growing more food*

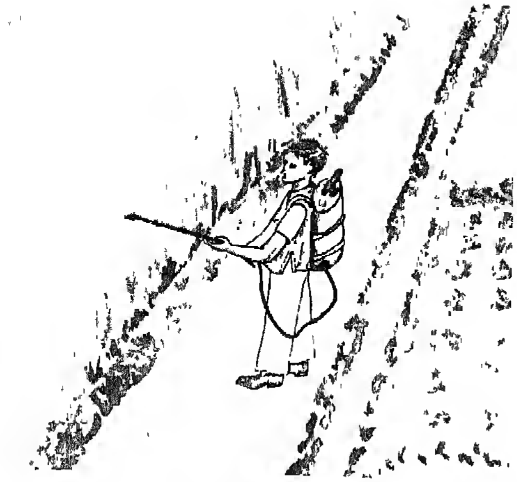


Fig 12.15

What other human activities disturb the balance in nature? As more and more people are born every day, the farmers have to find ways to grow more food crops They clear the forests and irrigate new land (Fig 12 14) They add fertilizer to grow more crops

The chemical sprays which farmers use to kill pests can harm other animals (Fig 12.15). Modernization and development are necessary But in the long run excessive use of fertilizers and pesticides harms human lives and also harms living forms by disturbing nature

As the number of people increases, more and more houses are needed for shelter Man destroys big forests to build big cities and towns (Fig 12.16)

Fig. 12.16 *Forests are destroyed for building cities.*

POLLUTION

Air, water and soil are essential for living organisms Every day, millions of tonnes of harmful wastes go into the air, water and soil These wastes poison the environment Any process which makes the air, water and soil harmful to the living beings is called pollution Man is mainly responsible for pollution

The air we breathe in is often very dirty Factories and houses burn gas, coal and oil These fuels produce smoke, which contains harmful gases and fine particles These cause lung diseases

Noise is also a kind of pollution If noises are too loud, they hurt the ears and disturb the birds and other animals in nature Constant loud noise may lead to deafness

Water is used for various purposes In the end waste water is produced In cities, dirty water or sewage is drained into rivers and lakes Many people use water from the same rivers or lakes In many places, people wash their clothes and vessels on the banks of rivers or ponds They also wash their animals in the same places They sometimes defecate in or near the water sources This water is polluted and can cause serious diseases. Name some diseases which are caused by dirty water.

ANSWER THESE

1 List three human activities which disturb the balance in nature.
2 Why is smoking injurious to human health?
3 What is pollution?

Each of us can do something to save nature's gifts air, water, soil, plants, and animals

You can learn more about insects, birds and animals. You should not kill them

You should not pluck leaves and break the branches of plants

You should not cut trees.

Even if you have a small piece of land, you can grow some plants on it and take care that the soil is not lost

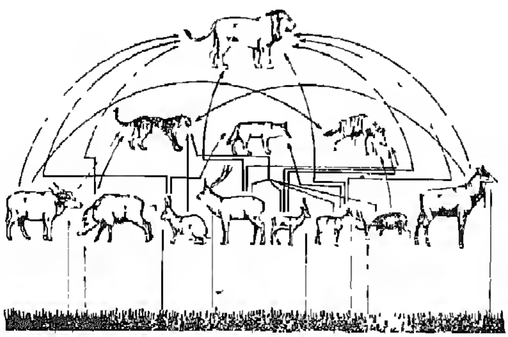
You should not throw waste materials in water or in your neighbourhood

YOU NOW KNOW

- All living and non-living objects and parts of the environment depend on one another in many ways.
- Plants depend on other plants, animals depend on other animals, and both plants and animals depend on each other They all ultimately depend on sunlight, soil, water and air for their existence
- The interdependence of organisms for food is very important If one part of the food chain is affected in any way, the whole chain is affected
- A balance exists in nature But this balance can be disturbed by human action such as deforestation and pollution
- If we want our environment to remain healthy, we must take care to protect it in every way

NOW ANSWER THESE

1 Write the names of 10 carnivorous animals which are found in India.
2 Write the names of 10 herbivorous animals that are popular domestic animals
3. Besides snakes, which other animals eat rats?
4 How are snakes useful to us?
5 Birds use plant material to make nests Do any birds use soil or other material to make nests?
6 Note down five different ways in which trees are useful to us
7 What are decomposers? Are they useful to us? Why?
8 What would happen if any of the links is missing in the food chain?
9 Why are plants called producers?
10 Write a short essay on 'Your Environment'



UNIT THIRTEEN

The Universe

THE UNIVERSE HAS always attracted the attention of the people. In the past, people knew very little about the universe Scientists explored the objects and phenomena occurring in the universe. As a result, we now know many more things about the universe Scientists have not stopped exploring the universe

The sun, the moon and the stars are some of the commonly known heavenly objects Besides these, there are many other heavenly objects about which very few people know You will be learning about these objects in this unit Do you know how vast our universe is? Do you know how the heavenly bodies move in space? Do you know what a satellite is, and how the man-made satellites are helping us? You will be able to answer these questions after studying this unit

13.1 *What is Universe?*

Look up at the sky on a clear cloudless night You will see a very large number of stars Some of them are bright, some are dim (Fig 13 1)

The stars are very large objects having the shape of a ball They are much larger than our earth. Some of them are even bigger than the sun They appear so small because they are very far away from us

You can see the stars only at night. The stars are present in the sky even in the day-time You cannot see them during the day because of the bright light of the sun.

If you look at the stars carefully at night, you will find that they appear to be twinkling You may also find some star-like objects in the sky which do not appear to twinkle. In fact, they are not stars. They are planets. The planets are the members of the family of our solar system They revolve round the sun

The sun is also a star It looks much bigger and brighter because it is much nearer to us. Many other stars are bigger than the sun, yet they look small and faint It is because they are very far away from us

You can see about 3,000 stars with naked eyes With the help of an instrument known as telescope, you can see many more stars The stars are very

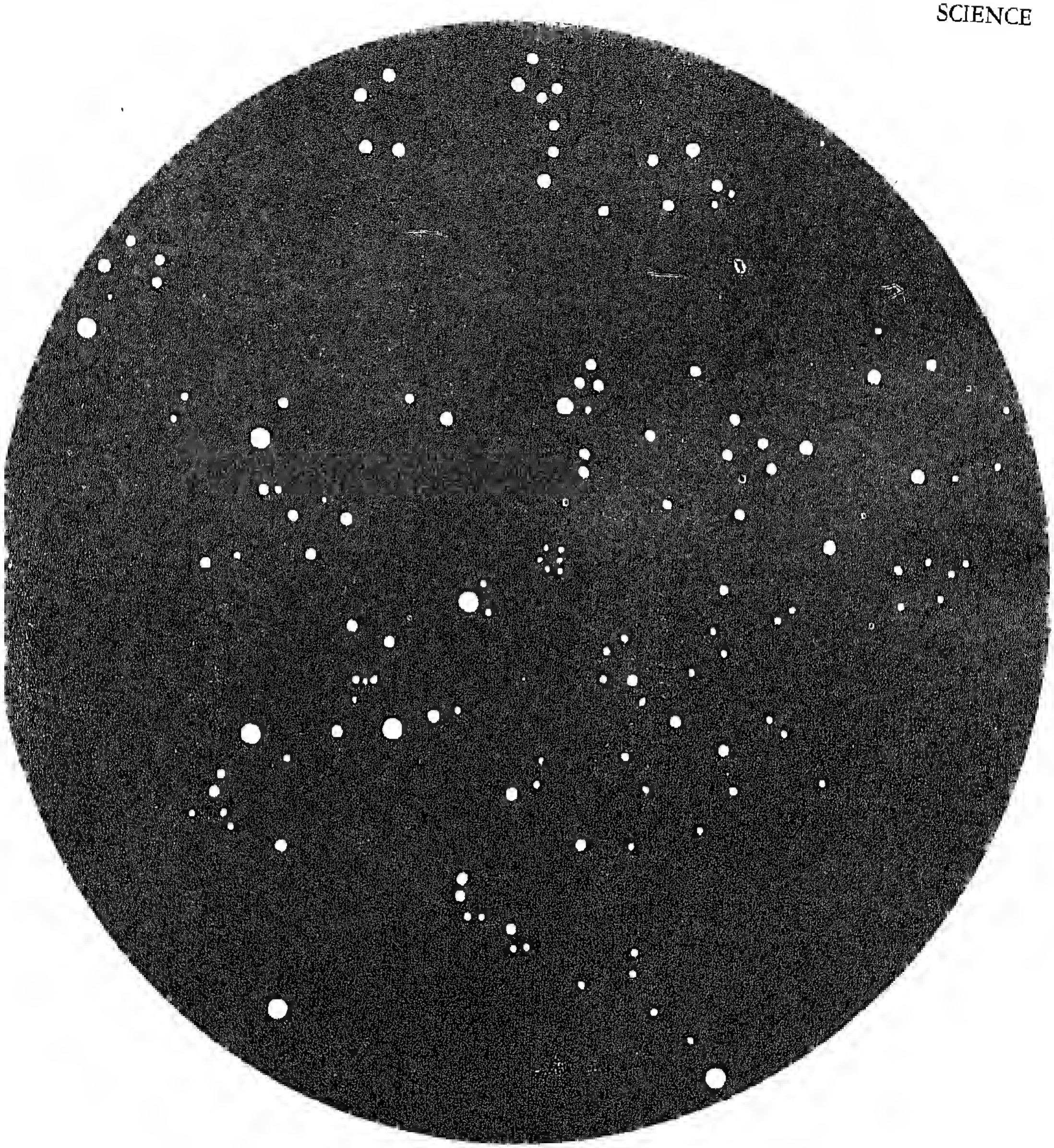


Fig. 13.1 *Night sky*

far away from one another. Even two nearest stars are many crores of kilometres apart

Usually you express large distances in kilometres. Even this unit is not suitable to express distances between the stars

and other heavenly bodies They are millions of kilometres away from one another The distances between them are therefore expressed in the unit of light years. One light year is the distance travelled by light in one year The speed of light is 3,00,000 kilometres per second. To know the distance light travels in one year, multiply 3,00,000 by the number of seconds in one year You will get the distance of about 9,460,800,000,000 kilometres Can you imagine how large this distance is?

You know that the distance between the sun and the earth is about 15 crore kilometres. Light comes from the sun to the earth in about 8 3 minutes. Therefore, you can say that the sun is about 8 3 light minutes away from the earth. The next nearest star, Proxima Centauri, is about 4.3 light years away from the earth The brightest star Sirus is about 8 7 light years away from the earth There are some stars which are even millions of light years away from the earth

Look at the sky at night when the moon is not there You may see a huge strip of faintly glowing light from north to south across the sky (Fig 13.2) It is known as the Milky Way It is made up of a cluster of countless stars. The sun is one of these stars There are several such clusters of stars in the universe. They are called galaxies. Our Milky Way is one of the millions of galaxies which exist in the universe.

All objects in the universe are in continuous motion. Our Milky Way with the sun and the stars is also moving (Fig. 13 3). It is also revolving on its axis Due to this, the sun moves at a speed of about 220 kilometres per second

ANSWER THESE

1 Many stars are much larger than the sun Why do these appear much smaller than the sun?
2. A star is eight light years away from the earth What does it mean?
3 What is a galaxy?
4 Why is the distance between stars expressed in light years?

13.2 *Constellations*

There are some stars which are always found in groups. These stars form some recognizable shape These groups of stars are known as constellations. All the stars of a constellation always stay together The shape of a constellation always remains the same The constellation appears to move in the sky from east to west.

One of the most famous constellations which you can see in the night sky is Ursa Major (Fig 13 4). It is also known as the Big Dipper, the Great Bear or the *Saptarishi*.

The name 'Big Dipper' is derived from the word 'dipper' which was used in

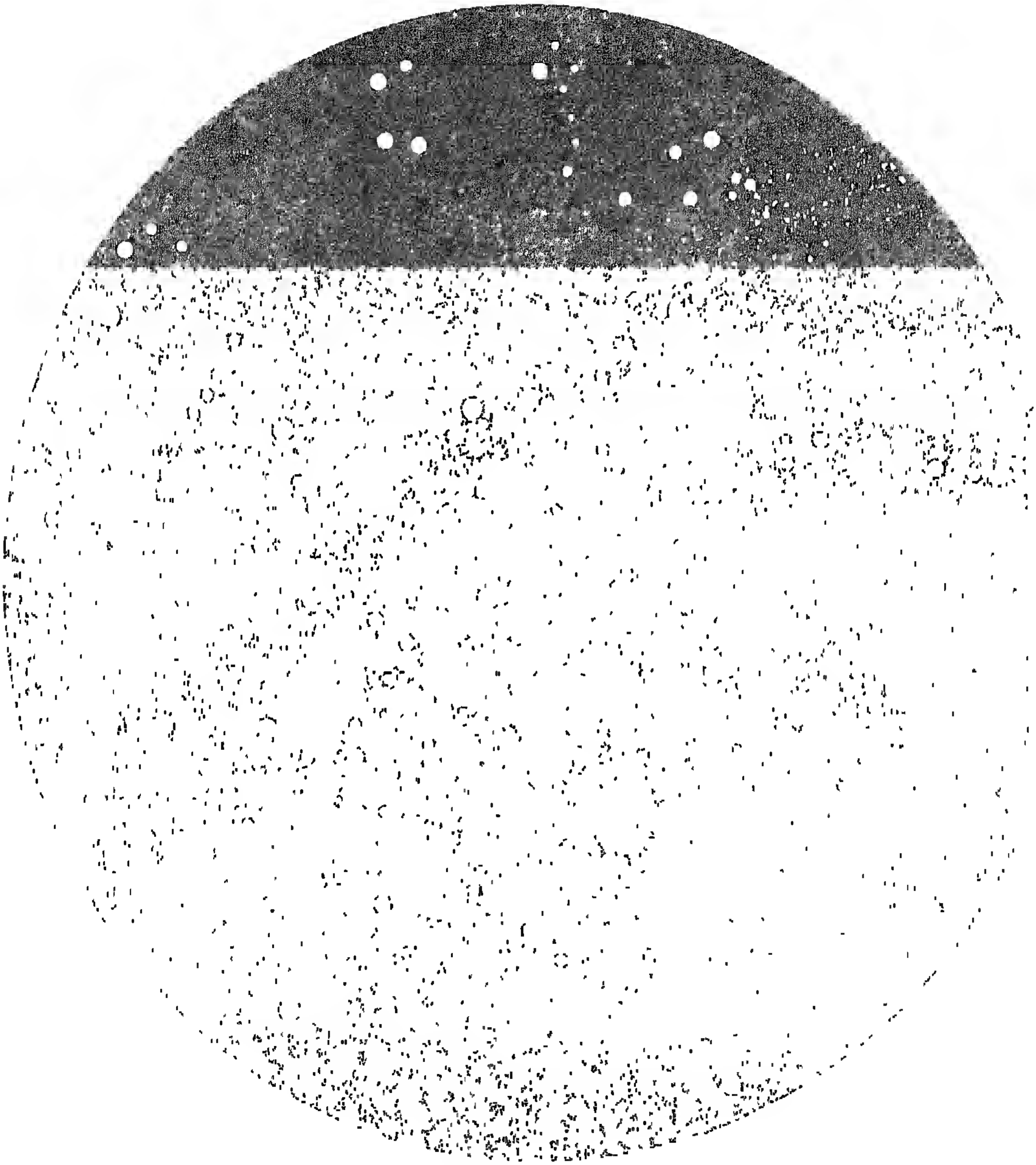


Fig 13 2 *The Milky Way as seen in the night sky.*

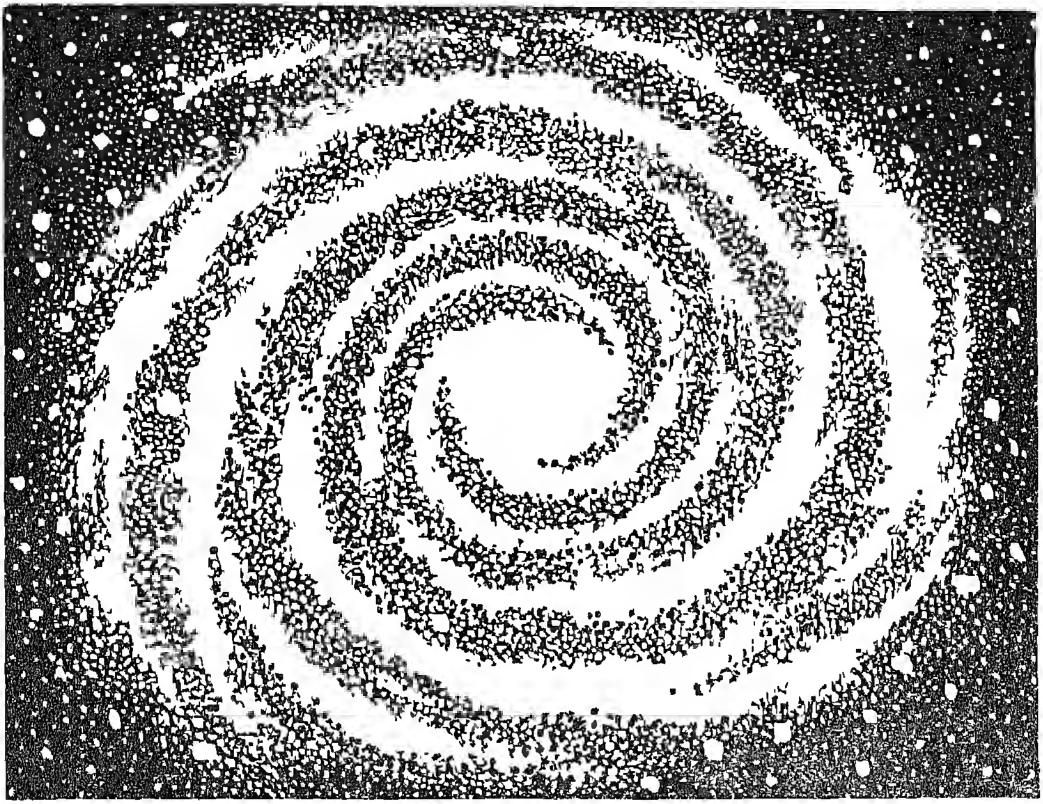


Fig. 13.3 *Rotating galaxy*

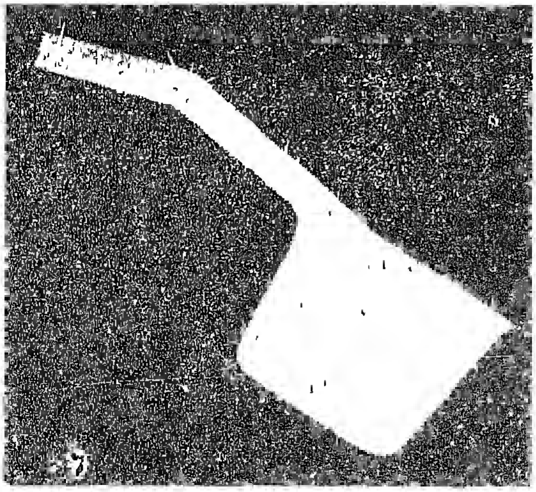


Fig 13.4 *Ursa Major*

olden days to drink water There are seven stars in this constellation There are three stars in the handle of the dipper and four in its bowl (Fig 13 5)

If you look at Ursa Major at different times at night, you will find that it appears to move from east to west At some places Ursa Major looks like Fig. 13 6 and at other places it looks like Fig 13 7

With the help of Ursa Major you can locate the position of the pole-star The pole-star always remains in the same position in the sky It is commonly known as *Dhruva tara* You will find that

all stars appear to move from east to west but the pole-star remains fixed at the same place in the north.

To locate it, look at the two stars at the end of Ursa Major Imagine a line drawn through these two stars (Fig 13 8). Extend this imaginary line in the north direction This line will lead you to a star which is not too bright and around which there are no stars This is the pole-star

Orion is one of the well-known and most impressive constellations (Fig 13 9) In this constellation there is a greater number of bright stars than in any other known constellation Orion is also called *kalpurush* Orion appears like a hunter (Fig. 13.10) The three middle stars represent the belt of the hunter You can easily locate this constellation in the sky during winter In winter it can be seen in the sky in the late evening.

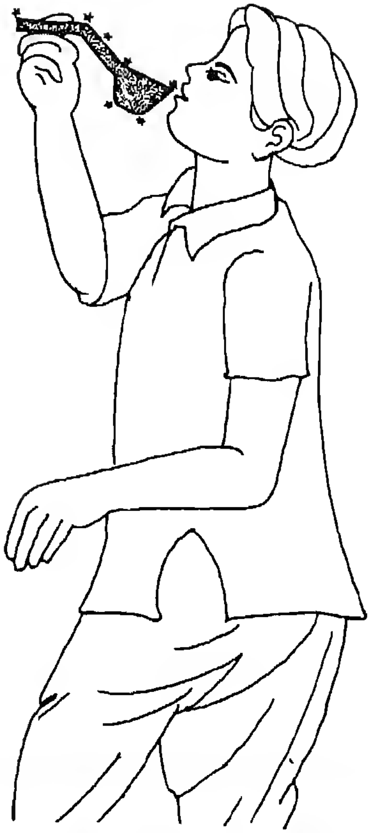


Fig. 13 5 *Drinking water from a dipper*

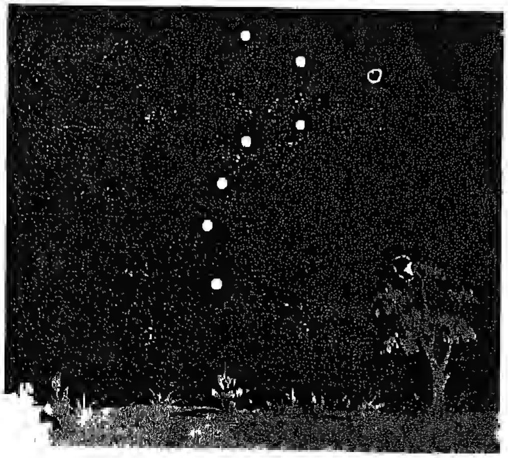


Fig. 13.6 *A position of the Big Dipper*

Fig 13.7 *Another position of the Big Dipper*

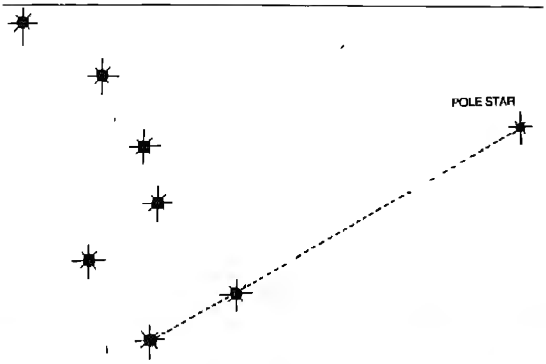


Fig. 13.8 *Location of the pole-star*

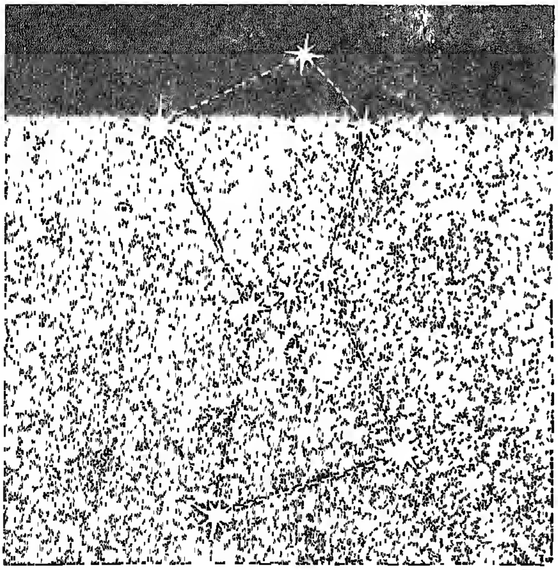


Fig. 13.9 *Constellation Orion*

Like the constellations, the other stars also appear to move from east to west. This is because of the rotation of the earth. You know that earth rotates from west to east. Can you tell why stars appear to move in the opposite direction, from east to west? You can understand this by performing a simple activity. Stand in the centre of a big room and start rotating. You will see that all the objects in the room appear to move in the direction opposite to your motion.

You must have also experienced that when the train or bus moves in the forward direction, the nearby trees and buildings appear to move in the backward direction. If the train travels from west to east, the trees and the buildings appear to move from east to west. In the same way, the stars appear to move from east to west, because the earth from where you view them moves from west to east.

Fig. 13.10 *Orion appears like a hunter.*

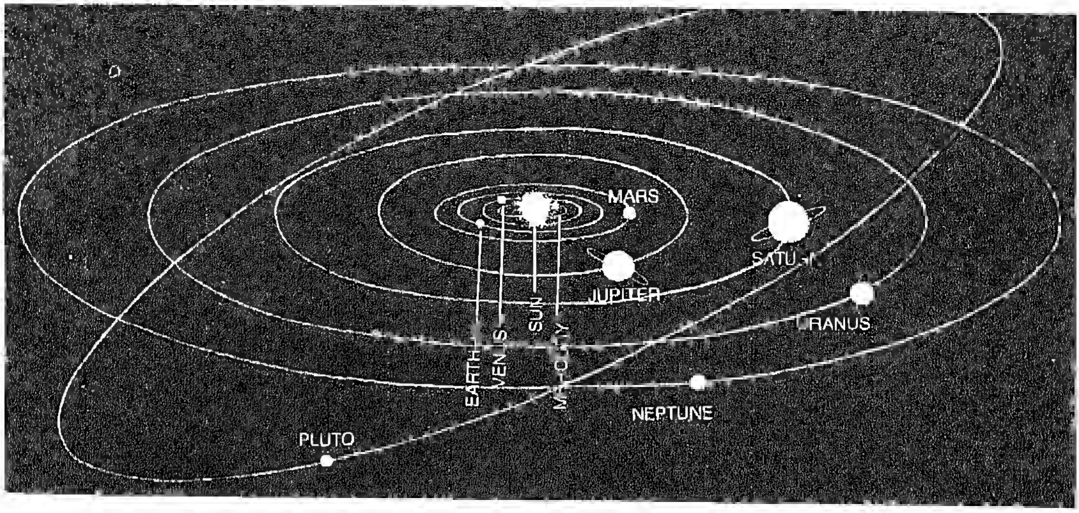


Fig 13.11 *Solar system*

ANSWER THESE

1. What is a constellation? Name any two constellations
2. Describe the procedure to locate the pole-star with the help of Ursa Major.
3. In which direction do stars appear to move in the sky? Why do they appear to move in this direction?
4. Draw the shapes of the following constellations showing the positions of their stars
   (i) Ursa Major
   (ii) Orion

13.3 *The Solar System*

The sun and the heavenly objects which revolve around it form the solar system (Fig 13.11) The earth, as you know, also revolves around the sun It is a member of the solar system It is a planet There are eight other planets that revolve around the sun The nine planets are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto

All the planets have a definite path in which they revolve. This path is called the orbit Between the orbits of Mars and Jupiter, there is a belt of small heavenly objects, known as asteroids

The planets do not have light of their own. They shine when light from the sun falls on them.

Different planets take different times to complete one revolution around the sun Mercury, which is nearest to the sun, takes a minimum time to complete one revolution It takes only 88 days, whereas Pluto which is the farthest planet, takes the maximum time (248 years)

Besides revolving around the sun the

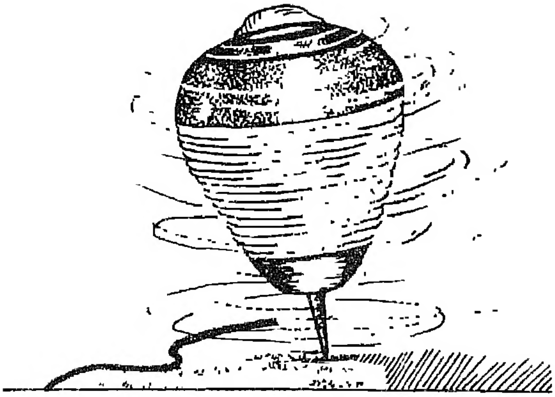


Fig. 13.12 *Rotation of a top*

planets also rotate on their own axis like a top (Fig 13.12) Different planets take different times to complete one rotation The time taken by a planet to complete one rotation is called its period of rotation The period of rotation for Jupiter is the minimum (9 hours 55 minutes) and for Venus the maximum (243 days)

Different planets are of different sizes Jupiter is the largest planet of our solar system It is so large that about 1,300 earths can be placed inside this giant planet

You know that the planets move around the sun There are some smaller objects which move around some of the planets These objects are known as *satellites* Till today 43 satellites are known These satellites are called natural satellites Some planets do not have any satellites whereas some have many Scientists may discover some more satellites in the near future

The earth has one satellite, the moon. It completes its revolution around the earth in 27 3 days It is nearer to the earth than any other heavenly object in the sky. Its distance from the earth is about 3,84,400 km

Besides natural satellites, there are some satellites which have been launched by human beings These satellites are called artificial satellites India has also built and launched some satellites Aryabhata was our first satellite (Fig 13 13) Some other Indian satellites are Bhaskara, Rohini, APPLE and INSAT

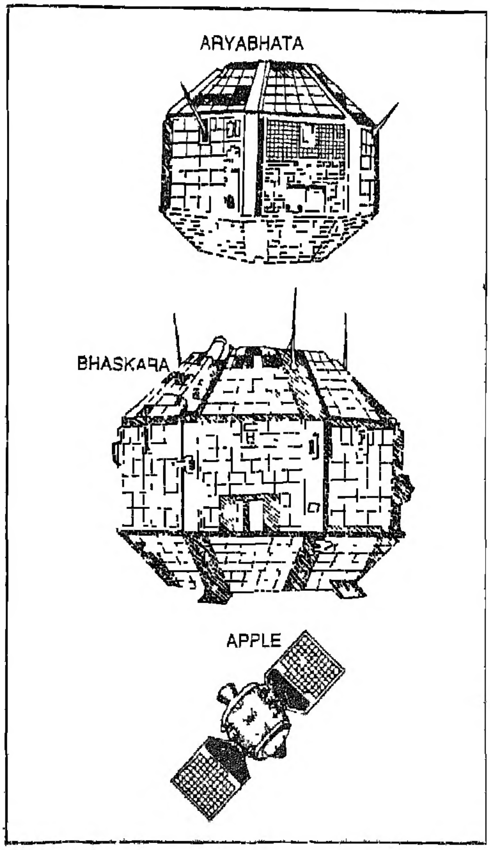


Fig 13.13 *Some Indian Satellites*

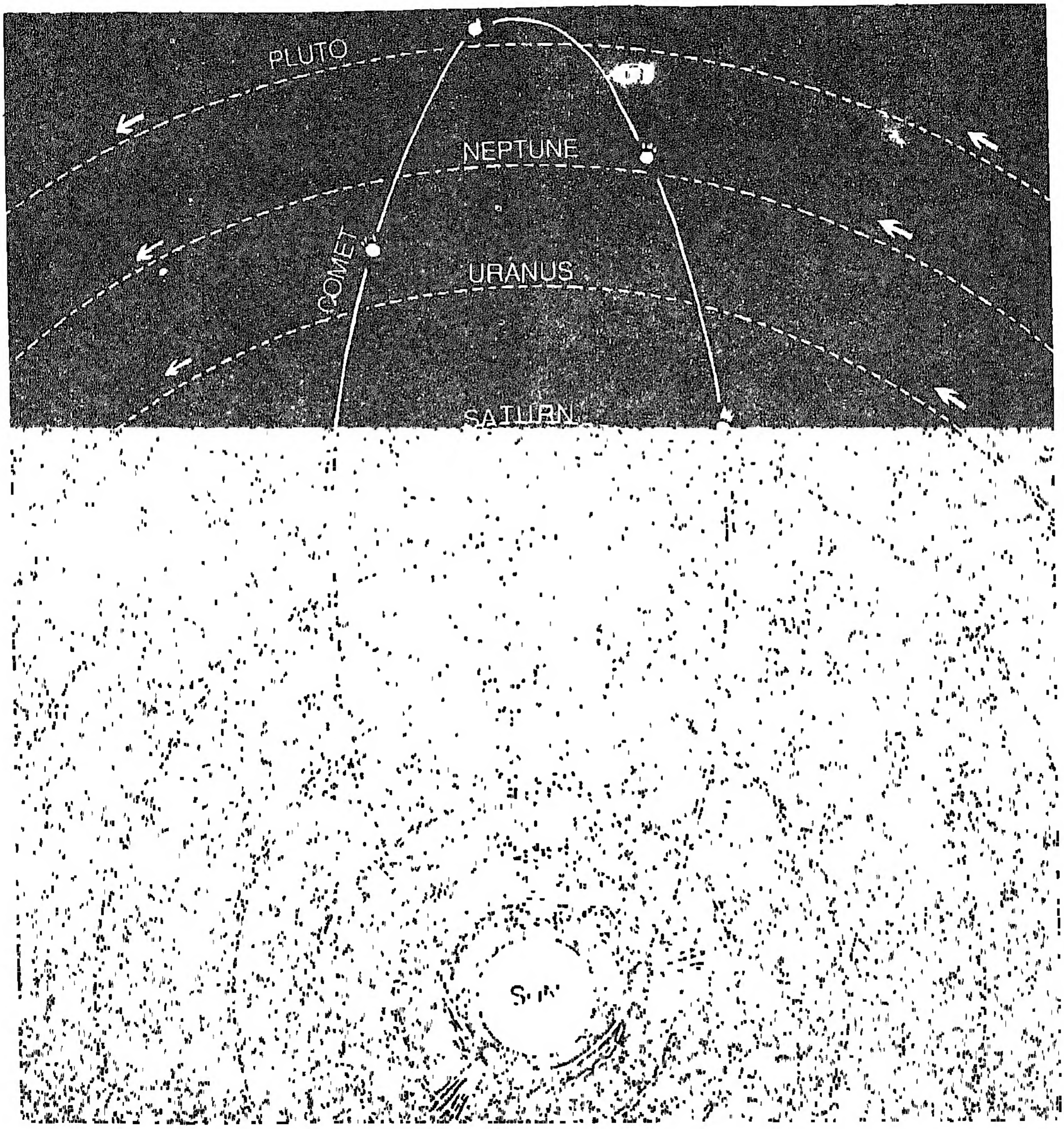


Fig 13.14 *Motion of Halley's comet*

Some of the uses of artificial satellites are:

(i) Weather forecasting
(ii) Television and radio transmission
(iii) Communication
(iv) Improvement of agricultural production
(v) Locating mineral resources
(vi) Knowing more about space

In addition to planets and asteroids, there are some other heavenly objects which revolve around the sun These are comets You must have heard about Halley's comet (Fig 13 14) which appeared in early 1986, after 76 years Comets are also the members of our solar system

At night, when the sky is clear and the moon is not there, you may sometimes see bright streaks of light in the sky (Fig 13 15) These are called shooting stars In fact, they are not stars They are called *meteors.* A meteor is usually a small heavenly object moving around the sun. When it enters the earth's atmosphere with a very high speed, it burns up due to friction Thus, a bright streak of light is produced A few meteors reach the earth without burning up completely They are called *meteorites*

Try to recognize some planets in the night sky Venus is the brightest of all the planets in the night sky. Moon is the only heavenly object which appears brighter than Venus. Sometimes Venus appears in the eastern sky before sun rise So, many people call it a morning star, although it is not a star At some other times it appears in the western sky, after sunset Then it is called an evening star

You can also recognize Mars in the night sky It appears reddish Jupiter appears almost as bright as Venus in the night sky Sometimes Jupiter can be seen throughout the night. At such times it rises in the east in the evening and sets in the west in the early morning.

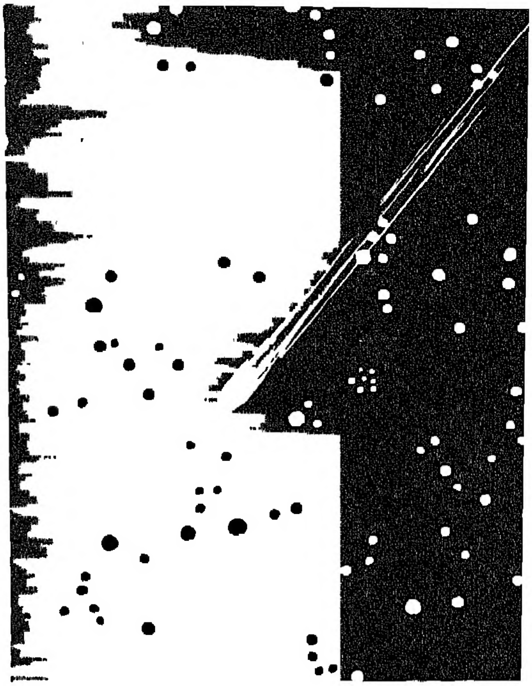


Fig. 13.15 *Meteor in the night*

ANSWER THESE

1 What is a solar system?
2 Name the planets of the solar system.
3. What is the difference between a planet and a satellite?
4 Mention three uses of an artificial satellite
5 Name the planet which is the nearest to the sun
6 Name two objects other than planets, which are members of the solar system.
7 How much time does the earth take to complete one rotation on its own axis and one revolution round the sun?

39.9.8.f

YOU NOW KNOW

- The stars are very large objects having the shape of a ball
- The stars appear to be twinkling whereas the planets do not
- The sun is also a star It is the nearest star to the earth
- The stars are very far away from one another
- Distances between heavenly objects are measured in the unit of light year
- There are millions of galaxies in the space The sun is one of the stars in our Milky Way
- All the objects in the universe are in continuous motion.
- Constellations are a group of stars which have some recognizable shapes
- All planets and stars, except the pole-star, appear to move from east to west because the earth moves from west to east
- The solar system consists of nine planets, asteroids, comets and meteors
- Meteors are heavenly objects which burn up in the earth's atmosphere producing an intense streak of light
- Meteorites are those meteors which do not completely burn up and reach the earth
- Different planets revolve round the sun in different orbits and rotate on their own axes The planets do not have their own light
- Satellites revolve around the planets

NOW ANSWER THESE

1 State two differences between a star and a planet

2 Name three heavenly bodies which you observe in the night sky

3 Name the constellation which helps you to locate the pole-star

4 Which constellation contains the maximum number of bright stars?

5 Arrange the following planets in order of their distance from the sun Mars, Pluto, Jupiter, Earth, Venus, Saturn, Mercury, Uranus and Neptune

6 Name the largest planet of the solar system

7 What is the difference between a meteor and a meteorite?

8 Name the planet which appears brightest in the sky

9 Fill in the blanks

(i) The planet which is the farthest from the sun is ____

(ii) The planet which appears reddish in colour is ________

(iii) Shooting stars are called ___

10 State whether the following statements are true or false?

(i) Orion is a member of our solar system

(ii) Pluto is the smallest planet of the solar system

(iii) Comets are the members of our solar system